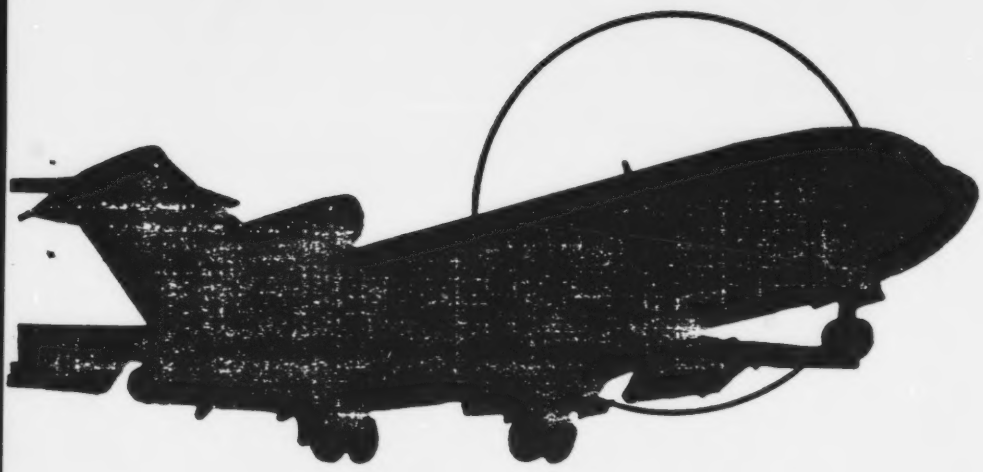
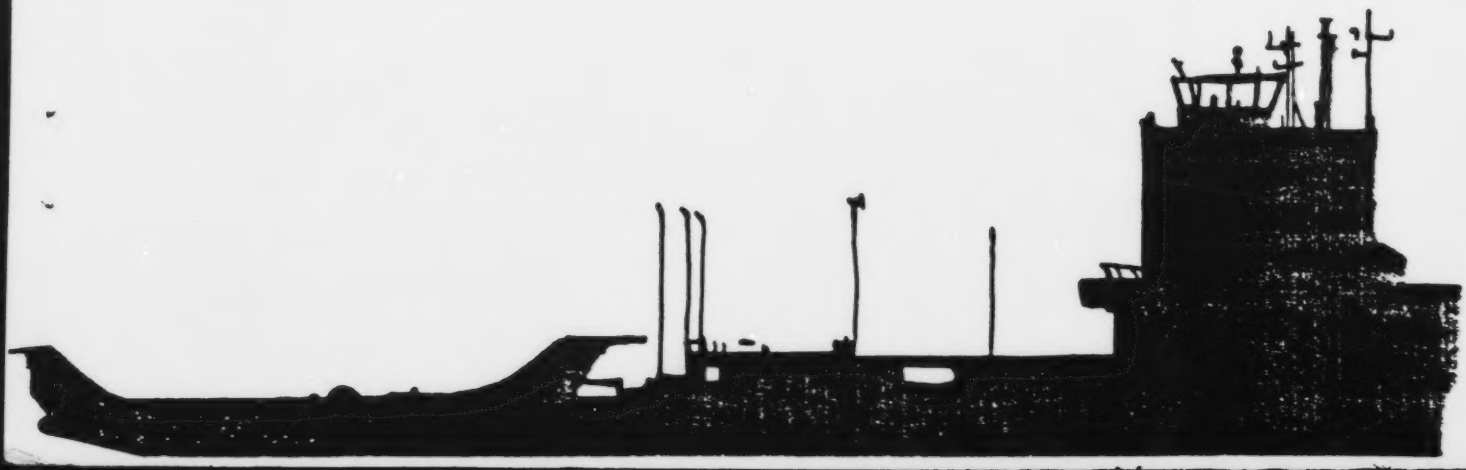


THE CASE FOR THE PARALLEL RUNWAY AT VANCOUVER INTERNATIONAL AIRPORT

SYPHER : MUELLER



THE CASE FOR THE

PARALLEL RUNWAY

AT

VANCOUVER INTERNATIONAL AIRPORT

THE CASE FOR THE PARALLEL RUNWAY AT VANCOUVER INTERNATIONAL AIRPORT

Prepared for
Cabinet Committee on Vancouver International Airport

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APPENDIX A: Study Terms of Reference

APPENDIX B: YVR Southside Users and Estimated 1988 Movements

Glossary

IMC	Instrument Meteorological Conditions - Ceiling and Visibility conditions that limit flying to aircraft and crews equipped, trained and operating on instruments.
IFR	Instrument Flight Rules - the rules applicable during IMC conditions. Often used interchangeably with IMC; as in "number of IFR movements"
VMC	Visual Meteorological Conditions - ceiling and visibility conditions that permit flight using visual references
VFR	Visual Flight Rules - the rules applicable during VMC conditions
FSS	Flight Service Station - a station providing radio services to pilots to advise on local conditions
MAINLINE UNIT TOLL	All services by Canadian Level 1 carriers - Air Canada C.A.I.L. and Wardair, as well as scheduled services of foreign carriers using aircraft with a gross take-off weight over 30,000 kg.
OTHER UNIT TOLL	All scheduled unit toll passenger services, other than mainline unit toll.

Executive Summary

It is readily apparent to travellers through Vancouver International Airport that there are congestion problems. Over the 12 month period June 1988 to May 1989, 39% of all departing flights were delayed as a result of congestion for a total of 7,250 hours of delay. On average, the delayed flights took off 16 minutes after leaving the gate. A substantial number of flights (2,800) had delays in excess of 30 minutes.

The Province of British Columbia is becoming concerned that deterioration of Vancouver International Airport's capability to meet traffic demands will ultimately mean a loss of new services, a loss of new business opportunities, and a loss of potential for additional jobs. This study was commissioned to examine the situation at the airport, to determine if the operational requirements for the need to provide additional capacity through the development of a new runway have been fully analyzed and documented, and to estimate the economic losses to British Columbia as a result of failure to address the current capacity problems.

The study examines the operational requirements, the environmental issues, the economic case for the new runway and the business case for the new runway, and proposes a federal and provincial action plan to ensure that the capacity issue is fully addressed as soon as possible.

The Operational Requirement

Vancouver International Airport currently serves a wide variety of roles, including: domestic, transborder and international hub for scheduled jet service; regional hub for commuter services in B.C. and into the U.S. Pacific Northwest; Canada's gateway to the Orient; and the principal base of operation for charter traffic supporting the province's resource and tourism industries. If the airport is going to continue to fulfill these roles then there is insufficient runway capacity today.

Current annual demand has exceeded the practical capacity of the runway of 277,000 movements per year. Runway capacity is not absolute, and this figure can be exceeded, but the current levels of delay will increase exponentially as this capacity is exceeded. While Transport Canada has taken several innovative steps to increase the capacity of the existing runways to approximately 300,000 movements per year, this enhanced capacity will also likely be exceeded in 1989 or 1990. Transport Canada has also proposed some measures to reduce traffic by 25,000 movements per year, but these measures have not been implemented. Flow control, that is the metering of arriving traffic, has been instituted, and this will tend to reduce departure delays, by transferring some of the delay load to arrivals. Because of the method of flow control used, internal B.C. flights will bear the brunt of arrival delays. Significant departure delays can be expected at most B.C. airports until flow control is removed.

Transport Canada's forecasts are for traffic to increase by 6% in 1989, and then for the rate of growth to taper off to 3%/year to 1996, and 1%/year in 1996-2001. These forecasts do not include any additional growth resulting from the efforts of Vancouver International Airport to enhance Pacific Rim traffic. Clearly the situation will continue to deteriorate unless bold steps are taken to either constrain demand or to provide substantial additional capacity.

Vancouver International is unique among large International Airports in that a significant percentage of the traffic continues to be small aircraft. Small, piston engine aircraft make up 43% of the traffic. Scheduled air carriers only make up 47.6% of the total traffic. Private, government and charter traffic is 25% of the total. Clearly, some of the small aircraft traffic needs to be located at Vancouver International Airport. The need for the remainder to continue to operate from Vancouver International has not been fully addressed, and can likely only be addressed by the introduction of minimum landing fees to establish a minimum market value for operations from the international airport and to encourage low value users to relocate to Boundary Bay.

However, even if a significant proportion of this smaller aircraft traffic was to be diverted to other airports, the airport would be at capacity in the 1993 to 1996 timeframe. Given the three year lead time required to provide additional runway capacity, it is essential to start the planning and design process today.

With the development of a new parallel runway, the annual capacity increases by 140,000 to 200,000 movements per year, a gain of 66% to 77%. Sufficient capacity is provided to carry the airport for at least 15 to 20 additional years. In fact, with projected technological improvements to air traffic control and with forecast changes to types of operations, the airport life may be extended indefinitely.

The Capital Program

The runway being proposed is a 9940 ft runway, parallel to the existing main runway and North of the Terminal Area. The estimated capital cost is $78 million in 1992, including all related environmental protection, lighting, navigation aids, etc.

The development of the runway will leave the airport unbalanced in terms of capacity. There is already a shortage of aircraft gates, and expansion of the terminal building and gates should be considered in conjunction with the runway development. This expansion would cost approximately $139 million in 1992. The runway and terminal expansion should be considered as one $217 million project to provide the needed capacity at the airport for the immediate future.

The Environmental Issues

All federal projects with a potentially significant environmental impact are subject to an Environmental Assessment and Review process (EARP). With several previous examinations of a parallel runway at Vancouver International, the terms of reference for the EARP are well established. They include: the justification for the project; analysis of the capabilities of other lower mainland airports; a detailed analysis of the pre-construction, construction and rehabilitation phases and their environmental impacts; an analysis of the impact of changes to airport operations on human and wildlife populations, including noise impacts and land value impacts; an analysis of the impact on ground transportation to the airport; and an examination of mitigation and monitoring steps that are needed.

It is anticipated that the EARP Panel will be reconstituted in late summer 1989 and will take 9-12 months to complete the environmental impact review. Transport Canada has been working to address all environmental issues.

As assessment of the EARP terms of reference indicates that the EARP will be used as a major focus of public input and review. The justification for the project will be subject to a full public review and the noise impacts on human populations will be the key environmental area.

The Economic Case for Growth

Vancouver International Airport contributes $1.5 billion per year to the Gross Domestic Product of B.C.. Direct and induced employment from the airport is 31,000 person-years, accounting for 2% of total provincial employment.

If the traffic at Vancouver is capped through the impact of congestion or through measures to control demand, there will be significant economic consequences, including; loss of traffic; encroachment of U.S. commuter operators in the B.C. Interior, diversion of Canada-Orient traffic, reduced expenditures on local goods and services, curtailed convention and tourism traffic throughout British Columbia, and a reduction in Vancouver's capability to serve as an international business centre.

By comparing unconstrained and constrained traffic growth at Vancouver International Airport, Transport Canada concluded that the impact of constraint in terms of delay costs and lost opportunities would be $1 billion (1989$ present value) for the 14 year period 1992-2006, and a loss of 5,900 person years of employment. An analysis of the capital costs of expansion and the associated benefits in terms of reduced delays and economic opportunities not foregone indicates that the pay back period for the runway is 5-9 years depending on assumptions, and that over a 25-year period, the net present value of developing the parallel runway is $1.3 billion

The Business Case for Growth

If development of the parallel runway is examined from the perspective of business investment, the project is:

- Affordable: The runway, and needed expansion of gates (a total cost of $217 million {1992 $} in 1990-1993 and $86 million {1998 $} in 1998-2001) could be financed commercially at 12% over a 30-year period. Also, considering only the incremental revenues from the project, the payback on the project is 18 years using a 12% interest rate.

- Wise: The rate of return for the total investment, including terminal expansions is 14.5% over 25 years

Action Plan

With the possible exception of the need to fully address the roles of the airport and the requirement of small aircraft to continue to operate at Vancouver International Airport, Transport Canada is well along the route to ensuring a decision to construct the parallel runway. To ensure that the project is completed in a timely fashion, the needed federal actions include:

- initiation of the EARP as soon as possible, with a conditional approval of the runway project
- establishment of Customs and a flight service station at Boundary Bay as soon as possible
- provision of more detailed site specific forecasts, sensitive to B.C. economic indicators
- parallel development of the project to expand aircraft gates at the airport
- implementation of a minimum fee
- additional analysis of the need for South side traffic to remain at the airport
- analysis of the roles and capabilities of all lower mainland airports in the next 20 years

There are several Provincial actions that could contribute to success, including:

- ensuring that the Regional Transportation Plan for the lower mainland addresses road and transit access to the airport for the next 20 years
- encouraging the federal government to maintain a tight time schedule on the process to ensure a summer 1990 final decision
- inquiring to ensure that federal government has the capital funds to undertake the project and is prepared to commit them for the fall of 1990

Overall, with a few areas of concern, all of the project prerequisites have been met or are currently underway.

I INTRODUCTION

A. DEMAND

Vancouver International Airport (YVR) is the focus of Western Canada's aviation activity. More than any other comparable facility, the airport plays a wide range of disparate roles, each making unique requirements for operating procedures and infrastructure. The airport's major roles include:

- The major west coast node for Canada's long haul domestic services.
- An important airport for short haul commuter traffic, particularly with Calgary and Edmonton.
- An important source of transborder traffic, particularly along the Pacific Coastal axis.
- The gateway to the British Columbia interior, to coastal communities, and to the Yukon.
- A significant node for polar services to the United Kingdom and Continental Europe.
- Canada's primary gateway to and from the Pacific Rim.
- The focus of General Aviation activity in support of British Columbia's resource and tourism sectors.
- An important operating and maintenance base for numerous national, regional and local carriers.

The ability of the Vancouver International Airport to play these diversified roles in an effective manner has become a matter of increasing contention. Operations at YVR are suffering from growing airside congestion, particularly in runway capacity. While a set of parallel runways is characteristic of airports comparable to YVR, the Vancouver facility continues to rely on a single long runway and a shorter cross runway. There is concern that the resulting delays and higher operating costs will result in airline service cuts and may discourage new entrants.

Vancouver Airport Traffic: History and Outlook

The Federal program for Economic Regulatory Reform has led to a major restructuring of the Canadian airline industry. Through allowing market forces rather than artificial entry barriers to prevail, the new National Transportation Act legislation has spawned considerable market innovation, price competition, network refinement and corporate restructuring by Canada's airlines. The growing economic liberalism has also played a major role in terms of new bilateral agreements, of which the Open-Skies type Canada-United Kingdom treaty is the most conspicuous example.

Perhaps no national airport better reflects the recent trends in Canadian aviation than Vancouver. The Airport was the first to experience the explosive growth in commuter services. Regional propjet operators, allied with the major carriers through marketing, operating, and equity relationships, have supplanted jet services on numerous routes throughout Canada. British Columbia, with many communities relatively close to Vancouver by air, but separated from the Lower Mainland by water, was the first region to witness this trend on a large scale. These aircraft have permitted a major expansion in frequencies on low volume, short haul routes.

Domestic Traffic

Growing competition on domestic routes has prompted the major carriers to emphasize wide body twin jet operations such as the 767 or A310. These aircraft have, since the early 80's, supplanted the L1011 and 747 aircraft which once prevailed on long haul domestic routes. With the attraction of wide body interiors, but the economics resulting from their smaller size, comparative fuel efficiency and two-person crews, these aircraft have allowed carriers to increase their frequencies sharply on the major routes between Western and Eastern Canada. This has placed further demands on runways, gate availability, and air traffic control systems nationwide.

Transborder Traffic

While transborder services are still constrained by the Canada-United States Bilateral, Vancouver has nevertheless experienced some improvement in its links to the United States. As a result of the Experimental Air Services Program, Air Cal, subsequently absorbed by American Airlines, began a Vancouver-San Jose service. Vancouver has experienced the effects of airline restructuring south of the border, as Delta has supplanted Western on Vancouver-California services, and the Spokane service has changed hands several times.

International Traffic

Canada's international traffic has grown rapidly, and there has been a progressive growth in scheduled services to new overseas destinations. Many foreign carriers have recently begun services to Canada, and Vancouver has seen more than its share of new entrants. Since 1977, Vancouver has witnessed the entry of British Airways, Lufthansa, KLM, Singapore Airlines, Air New Zealand, Air China, Cathay Pacific and Korean Air.

Recent Growth at Vancouver

The following table summarizes the growth in air traffic at Vancouver since 1977:

Table I-1. YVR Percentage Growth 1977-1987

	Enplaned/Deplaned Passengers - Percent Growth 1977-1987	Itinerant Movements Percent Growth 1977-1987
Mainline Unit Toll		
Domestic	21.9	17.1
Transborder	37.0	54.5
International	178.1	158.1
Total	32.3	28.0
Charter	43.2	33.5
Other Unit Toll	1063.3	733.3
Total Carrier	51.8	89.6
General	N/A	2.1
Total Itinerant		30.3

These growth rates are presented in Figure I-1. Vancouver International has shown steady growth through the 1980's. The continued growth, especially in the area of Other Unit Toll services, is the root cause of the present airside capacity shortage.

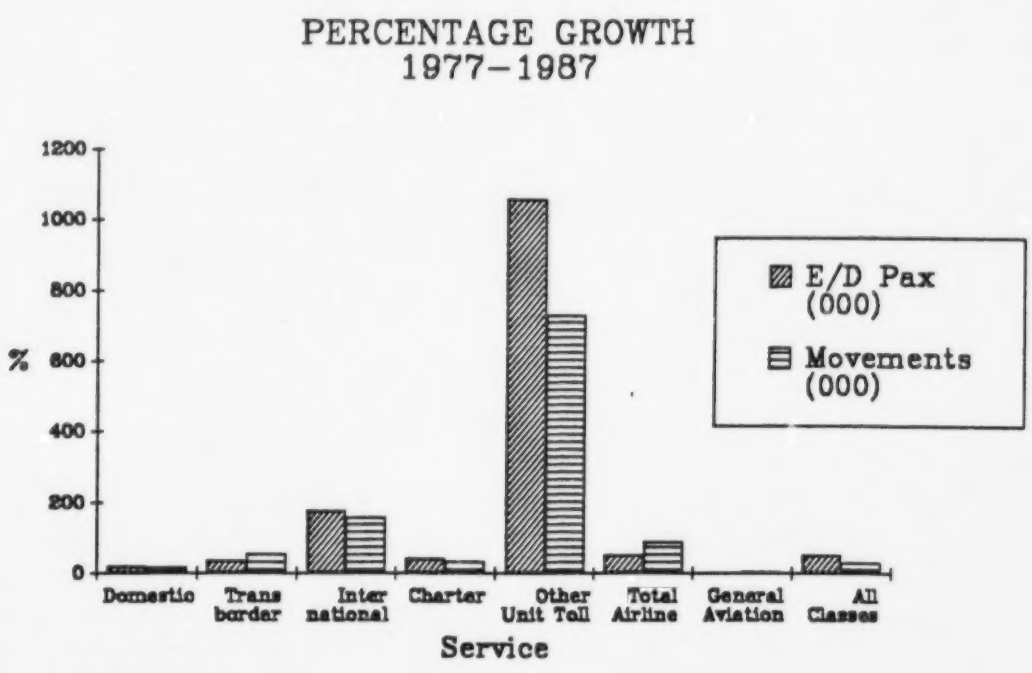


Figure I-1. YVR Rates of Growth by Sector and Type of Service 1977-1987

Traffic Composition

Figure I-3 illustrates the pattern of traffic growth 1980-1988 for IFR traffic, VFR traffic and floatplane traffic. Vancouver International is unusual in that a significant portion of the traffic does not use the runways. In 1987, of the 302,598 movements, 269,504 used the runways.

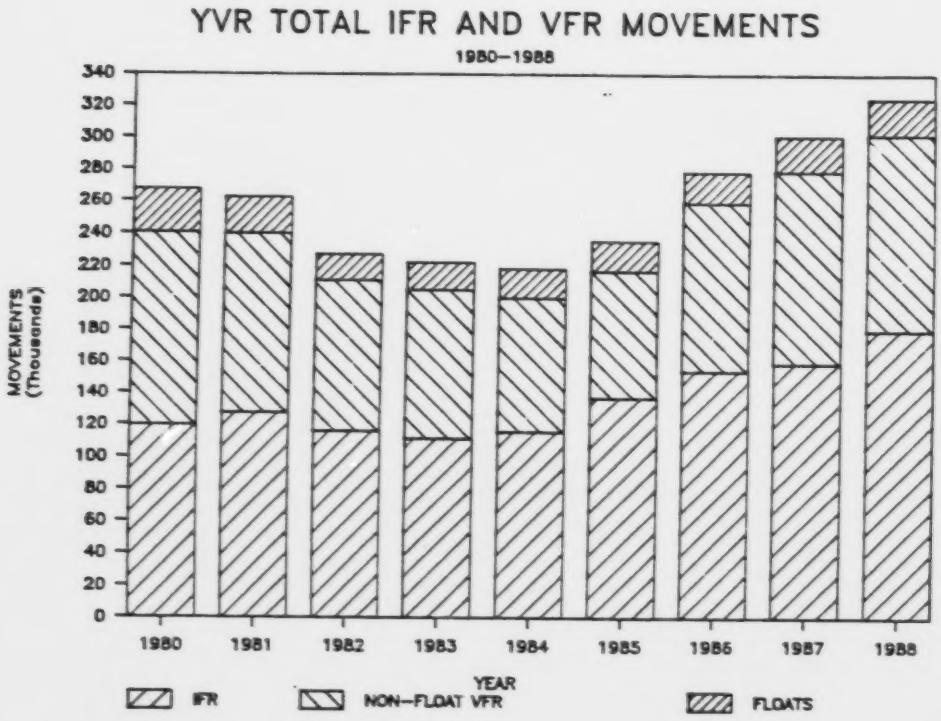
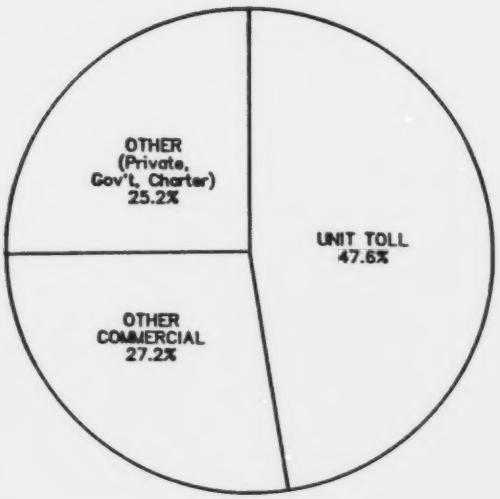
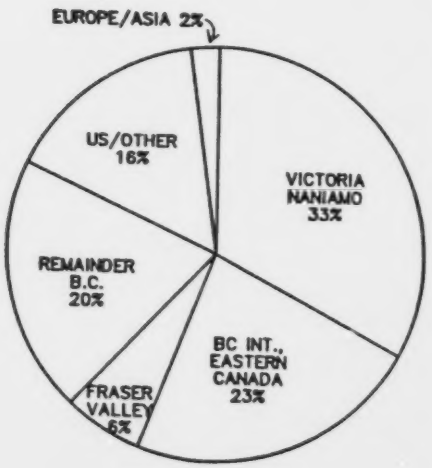


Figure I-2. Movements at Vancouver International Airport 1980 to 1988 IFR and VFR (Transport Canada)

The traffic at YVR is made up of a wide variety of aircraft types, purposes and trip origins. Figure I-3 summarizes the composition of the movements in 1987.





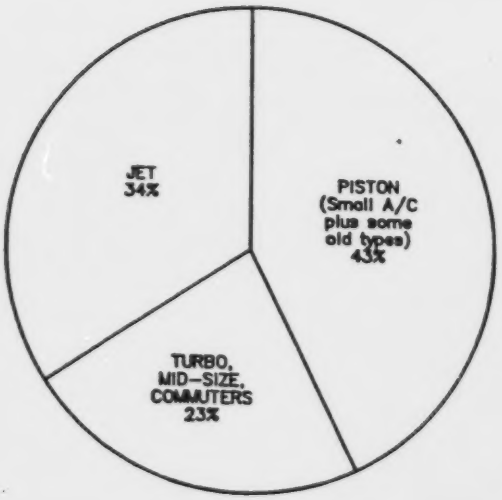


Figure I-3. Composition of Movements at Vancouver International Airport 1987

Passenger traffic at YVR has grown much more slowly than movements, with the effect that the passengers per unit toll movement has declined from 75 in 1980 to 45 in 1987. The relatively low average number of passengers per flight becomes an issue in the comparisons that are frequently used between airports. Vancouver's 7.4 million annual enplaned/deplaned volume in 1987 is much less than many international airports of limited runway capacity, and this fact is used to argue against the need for additional runway capacity. Table I-2 compares Vancouver to several other sites.

Table I-2. Comparison with Other International Airports 1987

Airports	Parallel Runways	Passenger Volume (E/D)	Air Transport Movements	Pax/ Movement
Vancouver	N	7.4M	165,468	44.5
Seattle	Y	14.4M	178,700	80.6
Gatwick	N	19.4M	171,100	113.4
Hong Kong	N	12.7M	73,600	172.6

Clearly, Vancouver handles a relatively high volume of traffic movements for its configuration. The issue of whether or not all the movements need to be at Vancouver is a function of the role of the airport, and is discussed in Section D of this Chapter.

Peaking

Typically, at many airports, traffic peaks occur in the morning and late afternoon periods with periods of relative low traffic during the middle of the day and in the evening. As traffic volumes have increased at Vancouver in recent years, the mid-day period has filled with traffic, so that the description of traffic peaks no longer applies (Figure I-4).

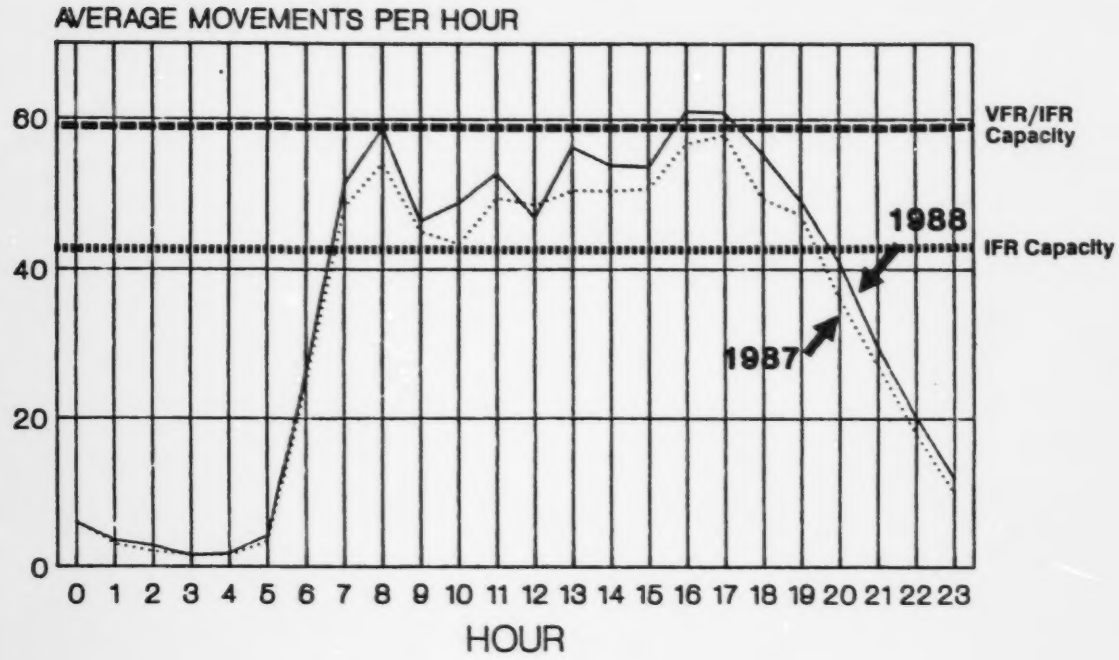


Figure I-4. Vancouver International Airport Movements/Hour by Time of Day 1988

In 1987, aircraft movements neared the capacity of the airport, with significant delays being incurred by many aircraft. In the sections which follow, the capacity of the airport will be reviewed and the reasons for delay, delay levels, and the costs of delays will be discussed.

Traffic Forecasts

Future Growth Prospects - Macroeconomic Factors

The future growth of air traffic at Vancouver will be determined partly by the prosperity of the Provincial resources sector. A cyclical rise in commodity demands and prices would provide a strong spur to local development, increase resource sector business profits and investment, and lead to a rapid increase in the demand for capacity at the Vancouver International Airport. While the economy of the Province is a major determinant to VIA's traffic volumes, Transport Canada expects the airport to outpace British Columbia because of the growing popularity of Western Canada among foreign tourists, the role of the airport as a western domestic hub, and continued growth in the commuter airline sector.

Figure I-5 portrays forecast growth of runway movements at Vancouver. It is expected that total movements will continue to grow, albeit at a decreasing rate. Growth will be sufficiently large to exacerbate any existing capacity shortfalls.

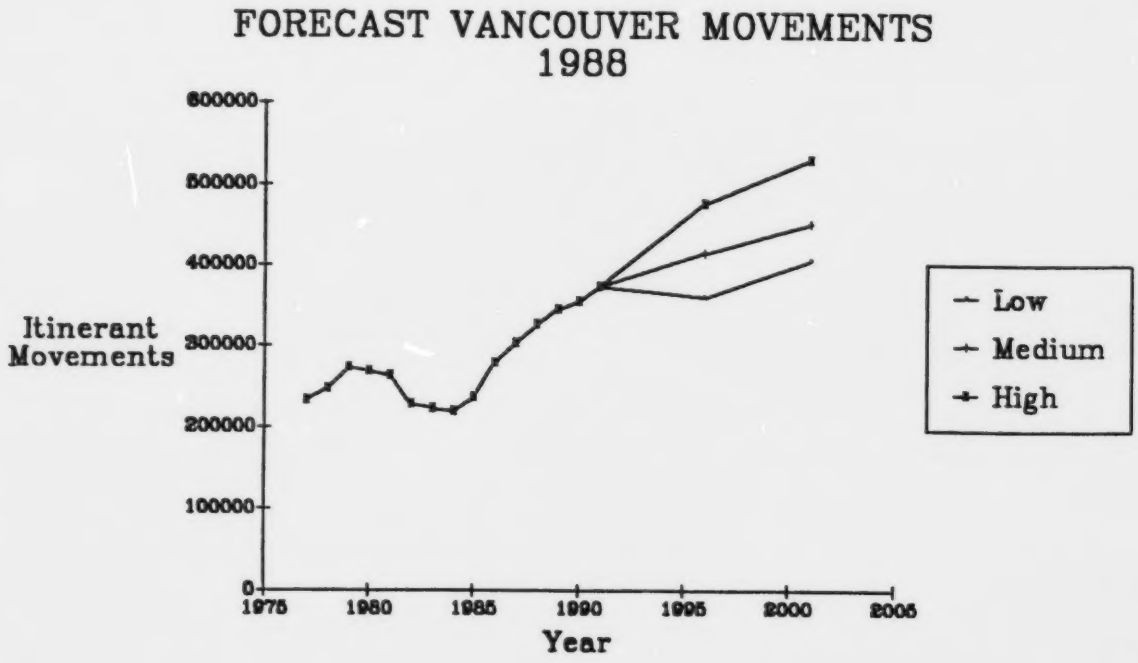


Figure I-5. YVR Forecast Runway Movements

Future Growth Prospects - North America

Commuter operators such as Air BC and Time Air are making increasing use of small (<100 seat) jet aircraft. Although these aircraft may displace yet smaller Dash 8-type propjets, and result in lower levels of frequency for equivalent capacity, there is a possibility that they may also be used as substitutes for larger aircraft of the 737 or DC-9 size. The higher frequencies that result may place further demands on Vancouver's runways, air traffic control facilities and gates even though the total capacity remains unchanged.

A new Canada-United States Bilateral could play a major role in promoting transborder traffic through Vancouver. Vancouver conspicuously lacks nonstop services to hubs in the interior Western and Central United States such as Salt Lake City, Dallas or Denver. These routes would likely see development under a new competitive regime.

Canadair's Regional Jet is slated for delivery in the second quarter of 1992. This aircraft will allow many long but low density routes to be developed. It will stimulate total traffic, but its small size in relation to the larger jets it replaces may cause an increase in total movements at many airports. If the aircraft promotes point-to-point services, overflying major hubs, it may ease airport congestion despite the higher resulting level of takeoffs and landings.

Future Growth Prospects - Pacific

Provided that Vancouver can retain its current portion of Canadian air trade with the Pacific Rim, the airport will continue to experience strong growth in its international traffic. The growing affinity of the city with Hong Kong, the relaxation of foreign travel restrictions on Korean nationals, and appreciating Taiwanese and Japanese currencies are all factors pointing to greater activity at Vancouver's airport.

Several factors specific to commercial aviation suggest a major growth in trans Pacific services from Vancouver:

- Successful efforts by the Vancouver gateway to recapture traffic lost to competing U.S airports as the result of implementation of the Pacific Rim Marketing Initiative. If these efforts succeed, movements will increase by 8400/year, a factor not included in current forecasts.
- Newly inaugurated services by Air China, Singapore Airlines and Korean Air.
- The possibility of bilateral air service agreements between Canada and Taiwan, Malaysia, the Philippines and Indonesia.
- The 1987 Division of the World, granting Air Canada long sought trans-Pacific rights.
- Dormant Pacific authority in the Canada-India, Canada-Britain and Canada-France bilateral agreements.
- Use of overwater twin jets on Vancouver-Orient services, allowing the development of services on "long and thin" routes.
- Eventual easing of capacity controls on the Canada-Australia/New Zealand air service agreements as a result of growing economic liberalism in all three nations.
- Opening of Osaka's Kansai Airport, granting Japan a second high capacity international gateway.

Despite these positive factors, Vancouver's position as Canada's gateway to the Pacific remains threatened even before airport congestion issues are considered. The following elements could restrain the Airport's international traffic, particularly if exacerbated by severe runway delays at Vancouver:

- Large volumes of Eastern Canada-Pacific traffic now processed through gateways in the United States.
- A growing network of U.S-Pacific air services, particularly from hubs in the hinterland. Several hubs, particularly Dallas, Chicago, Minneapolis and Detroit are well positioned to drain traffic from Canada.
- Aggressive expansion by Delta Airlines on trans Pacific routes from Portland. Delta is capable of offering convenient single-airline services from Vancouver to Tokyo, Seoul and Taipei.

- Award of the Seattle-Tokyo route to Continental Airlines, in competition with Northwest. Continental, with plans to establish a Seattle crew base, could be planning a large expansion of services to the Pacific from SeaTac.

- Imminent renegotiation of the United States-Japan bilateral, which could permit a large expansion in air services between the two nations. It will be especially favourable to airlines which have recently entered or plan to enter the Japanese market.

- Marketing and traffic feed alliances between airlines of the United States and international operators eg. American and QANTAS. These enhance the ability of airports on the U.S west coast to function as gateways to all of North America.

- Rapid growth in capacity of Pacific carriers, particularly as a result of the 747-400 being fully integrated into long haul fleets.

- Expansion of direct Eastern Canada-Orient services. Three Pacific carriers, Air China, Korean Air and Thai International now service Toronto. Singapore Airlines also has plans to service Ontario. Air Canada presently flies from Toronto through London to Singapore. Canadian Airlines International has inaugurated nonstop Toronto-Tokyo services in a joint venture with Japan Airlines, and also offers Calgary-Edmonton-Tokyo flights.

Summary - Growth Prospects

The trends discussed above have crucial implications to the Second Runway Debate. Most importantly, the level of traffic at Vancouver is growing as the result of many factors, and will continue expanding through the foreseeable future. Transport Canada has forecast a 20.3% growth in total enplaned and deplaned passengers along with a 22.9% growth in total itinerant movements from 1987 to 1991. Moreover, changes to airline equipment and operations, with a shift to smaller aircraft, will result in a larger number of landings and takeoffs for the same number of passengers. This will exacerbate any existing problems of airside congestion.

Figure I-6 portrays the decline of aircraft passenger loads at Vancouver. This results from the growing popularity of propjet equipment on local services, and mainline carrier scheduling practices which emphasize high frequencies. However, Transport Canada forecasts that average aircraft sizes will increase after 1990. This results from substitution of 737 and 727 aircraft now used on domestic routes by 767 and A320 aircraft and a growth of international services using 747 equipment.

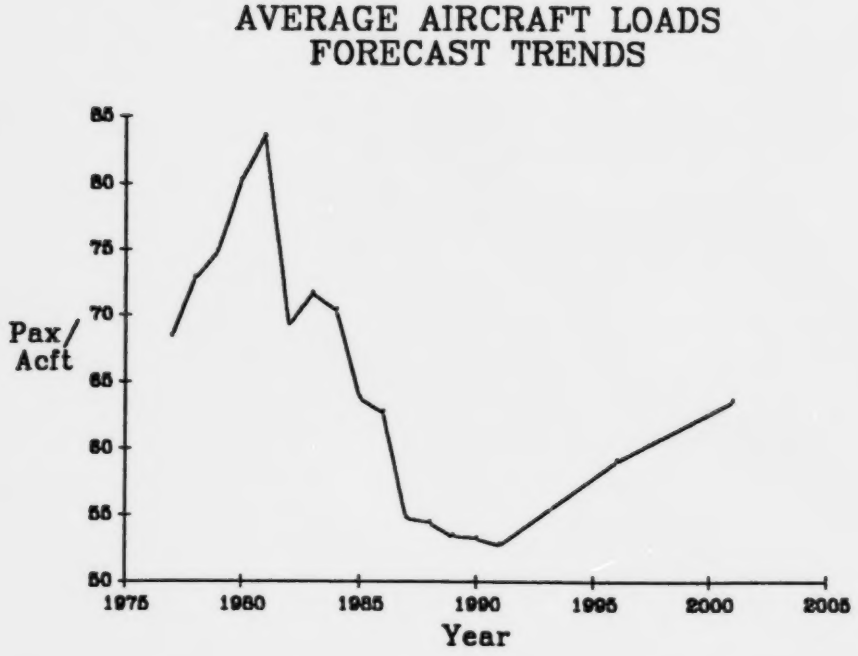


Figure I-6. Actual and Forecast Average Aircraft and Loads

There are growing opportunities for Vancouver to play an expanded role as Canada's primary gateway to the Orient and South Pacific, with all of the attendant potential for local economic development. But it must compete with airports throughout the continent, and specifically with Seattle. The growing number of competitors for this traffic constitutes a clear danger to the Lower Mainland; if for any reason the Vancouver International Airport is unable to accommodate the traffic proffered, other cities are prepared to capture expansion opportunities, and may even challenge its existing operations and traffic base. The question of airport infrastructure must be viewed not as a purely local issue but in the context of a multi-city rivalry that will help determine the future economic roles of the airport and the city of Vancouver.

While Vancouver International Airport has enjoyed long term growth, it has not been immune to the business cycle. As a result of the severe downturn in the early 80's, traffic for 1982-1984 was well below that of the 1977 base year. The growth noted previously is partially the result of a strong Canada-wide recovery. Many economists believe that the existing robustness in the economy is only temporary, and that a new recession will materialize towards the end of 1989. While a downturn may cause a temporary reduction in the Airport's level of activity, it will have no permanent impact on the long term growth trend. Because of the long lead time required for any major expansion of airport facilities, any recession should be viewed only as a temporary breathing space and an opportunity to initiate effective action. If this opportunity is missed, the strong growth of airport traffic will result in capacity constraints and foregone opportunities which will be far more severe than those experienced in 1989.

More than a decade has lapsed since deregulation in the United States. The emergent industry trends; yield management, hub and spoke systems, a reduction in interlining (exchanging connecting traffic between competing carriers), code sharing, etc. are well documented. There is growing industry concentration worldwide, with megacarriers of many nations tied into marketing, operating and, occasionally, equity relationships. This may culminate in multinational airlines, having enormous powers of concentrating traffic through a small number of hubs worldwide.

However, there is growing concern that facility constraints such as insufficient runway capacity at key airports, a shortage of gates, and slot controls will function as entry barriers; thwarting competition, driving up prices, discouraging market growth and defeating the original purposes of airline deregulation. Through its growing airside capacity problem, Vancouver is in a similar danger, and the city may forfeit many of the advantages of the growing economic liberalism. Additional airport capacity should be regarded as an investment taken to facilitate economic development throughout the Province. The economic implications of airport capacity go far beyond direct cost savings of airlines, but relate to the role that the Airport, and the City of Vancouver, will play in international commerce well into the next century.

B. CAPACITY

Vancouver International airport (international designator YVR) has a single primary runway of 11,000 ft, and a smaller (7,300 ft) cross wind runway. Figure I-7 illustrates.

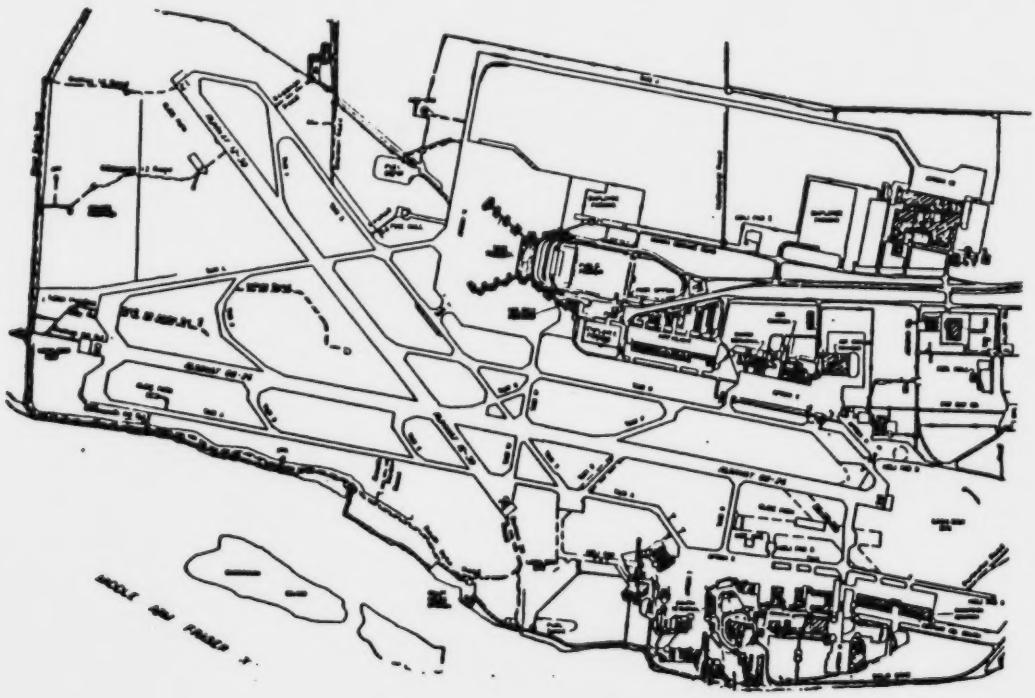


Figure I-7. Runway Configuration

The capacity of a runway, or combination of runways, to accept arrivals and departures is a complex function of:

- the physical configuration
- the mix of aircraft types using the airport
- runway occupancy times
- the mix of aircraft operating under visual flight Rules (VFR) and instrument Flight Rules (IFR), and
- the ratio of take-offs to landings
- the procedures being used by air traffic controllers.

The theoretical capacity would be the capacity achievable under optimum conditions. Since this is seldom achieved and is difficult to measure or model, the capacity definition used is practical capacity, which is a capacity related to delay.

For detailed planning of movements, hourly capacity (movements/hour) is normally used, while annual capacity (movements/year) is used for long term planning.

As Figure I-8 illustrates, delay increases geometically as movements per hour near capacity. The US and Canada have selected 4 minutes average delay as the point to define practical capacity. As Figure I-8 shows, after this point delays climb to very large numbers with few additional movements.

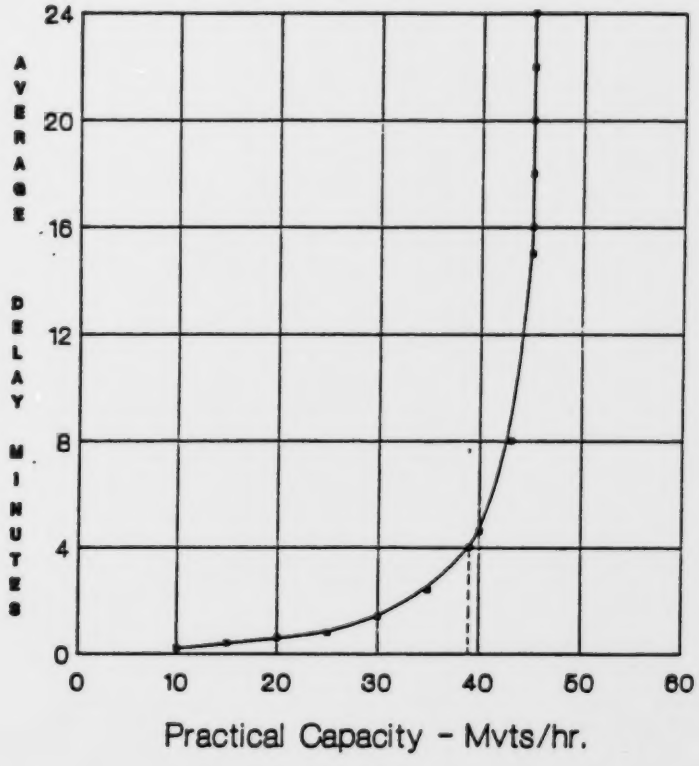


Figure I-8. The Relationship Between Movements, Delays and Practical Hourly Capacity

A four minute average delay does not imply a four minute delay for every aircraft. Delays tend to be imposed more often on departures than arrivals, and also tend to be poorly distributed so that with a 4 minute average delay, some aircraft will be experiencing 20 minute departure delays.

The practical hourly capacity, (also called Engineered Performance Standards by Transport Canada) can be calculated for each possible runway use combination as a function of the mix of aircraft, runway occupancy times, etc. For Vancouver, the inputs to calculating EPS include:

Aircraft Mix

- 45% light aircraft (<12,500 lb) - typically under 19 seats
- 46% medium aircraft (12,500 lb - 300,000 lb)
- 9% heavy aircraft (>300,000 lb - wide body aircraft)

Arrival/Departure Mix

- 50:50

Figure I-9 illustrates the performance standards for the various configurations of runways currently available at YVR.

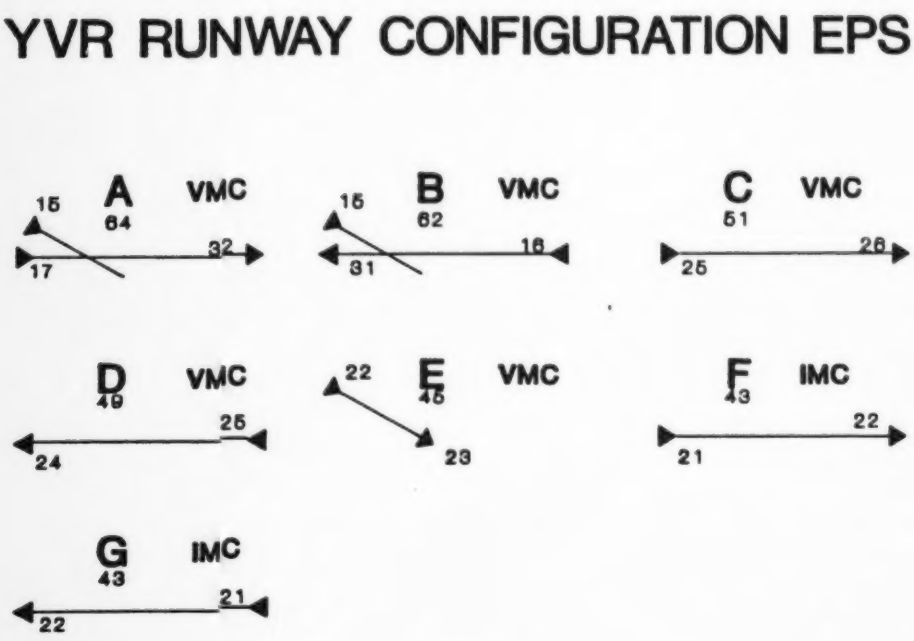


Figure I-9. Hourly Practical Capacities (EPS) for the Runway Configurations Available at YVR

The key points from this figure are:

- during conditions when VFR conditions prevail (visibility greater than 3 miles and ceiling greater than 1000 ft in controlled airspace) the maximum practical capacity is 64 movements hour (configuration A)

- during IFR conditions, the capacity drops significantly to 43 movements/hour (F and G)

Average hourly capacity is obtained by determining the availability of the various runway configurations throughout the year according to weather statistics. The methodology used examines the availability of the highest hourly capacity configuration, then the marginal contribution of each additional configuration in descending order of hourly capacity to arrive at average hourly capacity. At Vancouver this calculation is:

Configuration	Capacity		Marginal % Available		
A	64	X	68.4	=	43.78
B	56	X	3.3	=	2.03
C	51	X	0.3	=	0.14
D	49	X	21.1	=	10.40
E	45	X	0.3	=	0.14
F/G	43	X	6.5	=	2.77
Average Movements Per Hour					59.26

The annual practical capacity can then be obtained by multiplying the average capacity per hour times the airport annual hours of operation.

59.26 X 16 hours/day X 365 = 346,000 movements/year

In Vancouver, the Airport Capacity Enhancement Project team defined practical annual capacity as 80% of the 346,000 movements calculated above, to account for "unusable" capacity during weekends and late evening periods (80% X 346,000 = 277,000). For planning purposes, this seems to be a reasonable approach, because there is no practical way to relocate most weekday traffic into the weekend periods.

Demand-Capacity Comparisons

Traffic forecasts for Vancouver International Airport indicate that movements will increase by almost 6% in 1989, with the average growth rate in total traffic declining in subsequent years to 3% in the 1990-1996 period, and 1% in the 1996 to 2001 period. Figure I-10 compares the forecast annual demand to the calculated 277,000 movement annual capacity. With the current runway configuration and practices, capacity is exceeded from 1989 onwards.

YVR CAPACITY vs. DEMAND
MEDIUM FORECAST

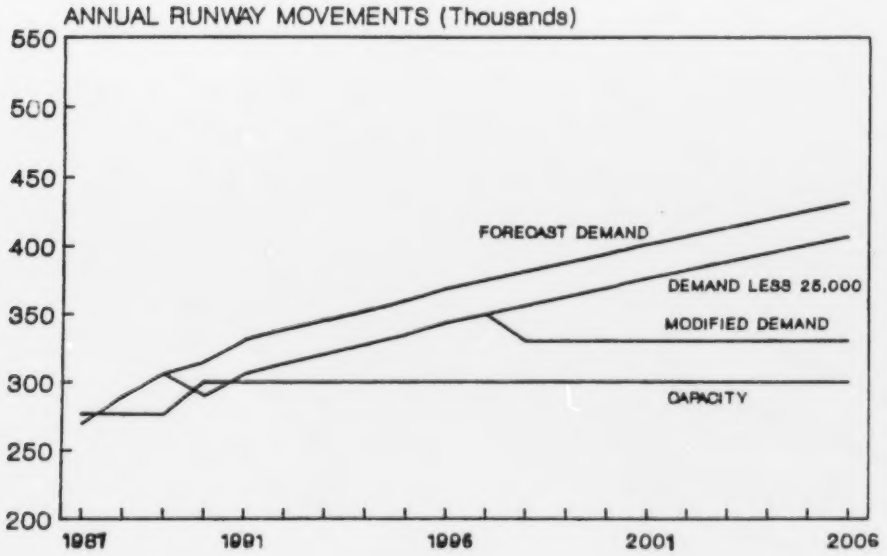


Figure I-10. Forecast Annual Runway Movements and Annual Capacity (Transport Canada)

On a time of day basis, the hourly capacity will frequently be exceeded. Figure I-11 illustrates average hourly movements for 1987 and 1988 compared to the practical hourly capacity of 59.3.

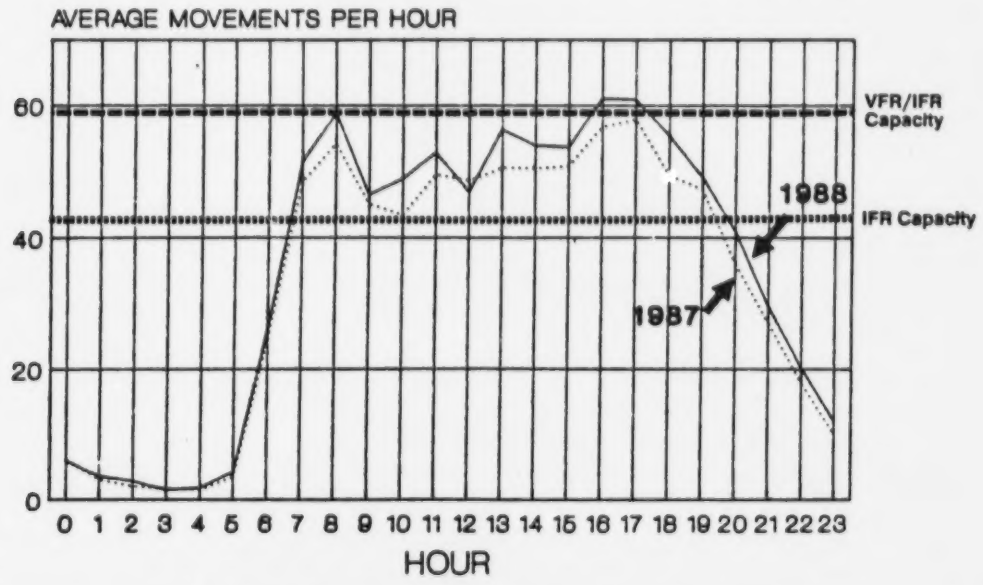


Figure I-11. Average Hourly Movements 1987 and 1988 (weekdays) and Capacities (ACE Team)

If movements were shifted in time so that the entire period 0700 - 1800 each day was uniform in hourly demand, only 7% additional capacity would be provided: not much more than the 1989 forecast rate of growth.

The Airport Capacity Enhancement project team collected data on three hour traffic demands throughout 1989. Figure I-12 illustrates the distribution of these three hour demands descending in order of traffic volume. All the published peak 40 three hour periods exceeded the three hour capacity of 178 movements, and all the published peak 40 IFR demand periods exceeded the three hour IFR capacity of 129.

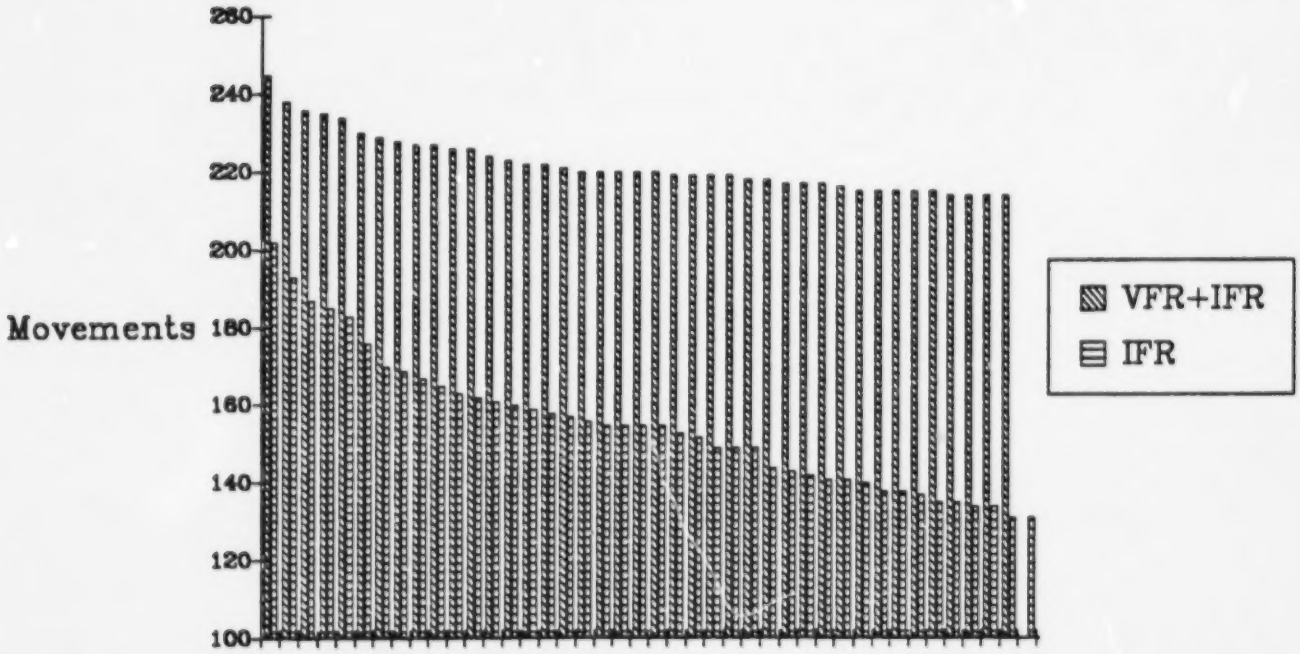


Figure I-12. Distribution of 1988 Peak Three Hour Periods (top 40 peaks)

In many ways YVR is fortunate that VFR conditions prevail. Under IFR conditions, the airport is inadequate today. These conditions occur on average during 380 airport operating hours per year. If it is assumed that all the jet and turboprop aircraft using the airport are IFR equipped (167,980 movements in 1987), then the IFR equipped movements will exceed the annual IFR capacity by 90/91.

Overall, the demand - capacity comparison indicate that without changes to capacity or to demand, Vancouver was already running at capacity in 1987 and the situation will continue to deteriorate in the coming years, with delays increasing in duration and affecting more aircraft.

C. CONGESTION AND THE COSTS OF CONGESTION

Even without calculations of practical annual capacity, the airport staff and anyone who travels through Vancouver International became aware of capacity problems through the delays experienced in 1987 and 1988. As a result of frequent delays and user complaints, Transport Canada established the Airport Capacity Enhancement (ACE) Project Team in May 1988. One of the first tasks of the team, in addition to examining opportunities to reduce delays, was to capture the magnitude of delays. From June 1988 onwards Transport Canada recorded departure delays only. Delays were calculated by calculating the difference between push back time and take off minus an 8 minute allowance for taxiing. Transport Canada's approach to delay clearly understates delay:

- the 8 minute allowance is probably too large
- on-gate delays, which can occur when a queue of departing aircraft is already in place are not captured
- arrival delays are not captured (it is intended that a process to capture these will be in place summer 1989).

With recognition that the delays shown are understated, it is nonetheless worthwhile to examine Transport Canada's delay figures:

- Over the 12 month period June 88-May 89, approximately 39% of all departing flights were delayed - a total of 7,250 hours of delay
- for the 53,200 delayed flights, the average delay was 8 minutes; i.e. on average they took off 16 minutes after push back.

Figure I-13 illustrates the measured number of delayed aircraft for each day in July and October 1988. Figure I-14 illustrates the day by day delay for these two months. In July, 5,491 departing aircraft were delayed a total of 47,002 minutes. In October 4,791 aircraft were delayed 52,713 minutes.

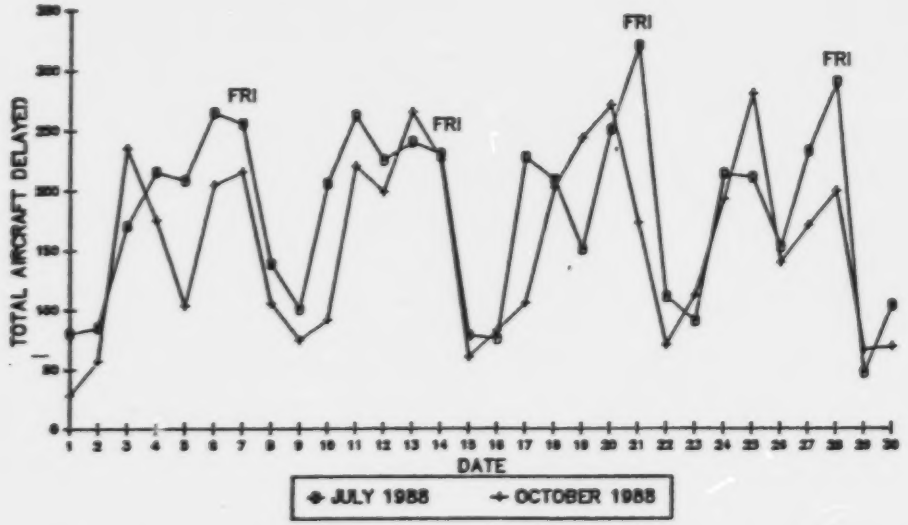


Figure I-13. Delayed Aircraft by Day July 88 and October 88 (ACE Team)

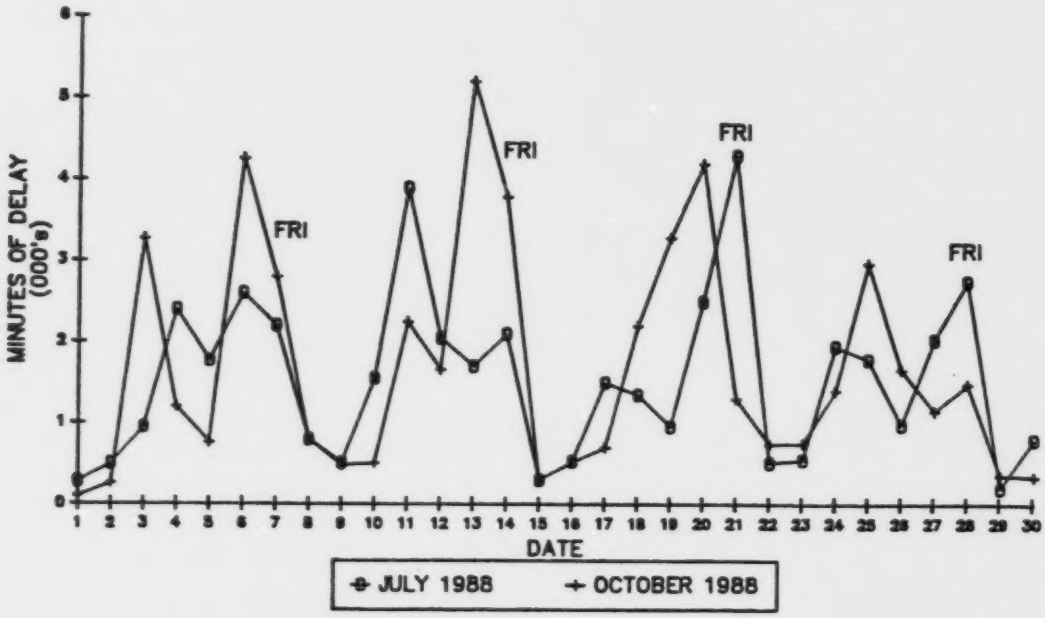


Figure I-14. Delays by Day July 88 and October 88 (ACE Team)

Figure I-15 illustrates the calculated delay month by month (May 89 is estimated).

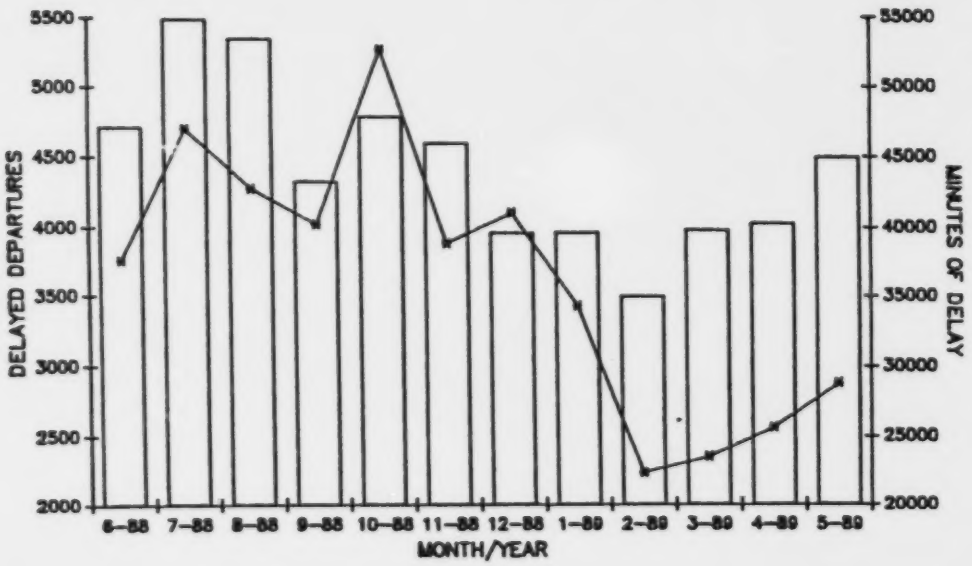


Figure I-15 Number of Delayed Departures and Delays (Minutes) by Month June 88 - May 89 (ACE Team)

The Distribution of Delay

Earlier, in the discussion on the relationship of capacity to delay, it was pointed out that even at 4 minutes average delay, some aircraft could be delayed as long as 20 minutes or more. A brief examination of the January - May 89 data for Vancouver substantiates this. A total of 21,985 movements were delayed an average of 9.65 minutes. As Figure I-16 shows, the delays are distributed over a wide time band with 3,174 flights (6% of the total departures) incurring an average of 33.5 minutes of delay (i.e. they took-off 3/4 of an hour after push back). The total delay was 212,055 minutes over the 5 month period. If the delays under 4 minutes are removed from the total, only 10% of the delays are removed and the average delay for the remaining delayed departures was 15.4 minutes.

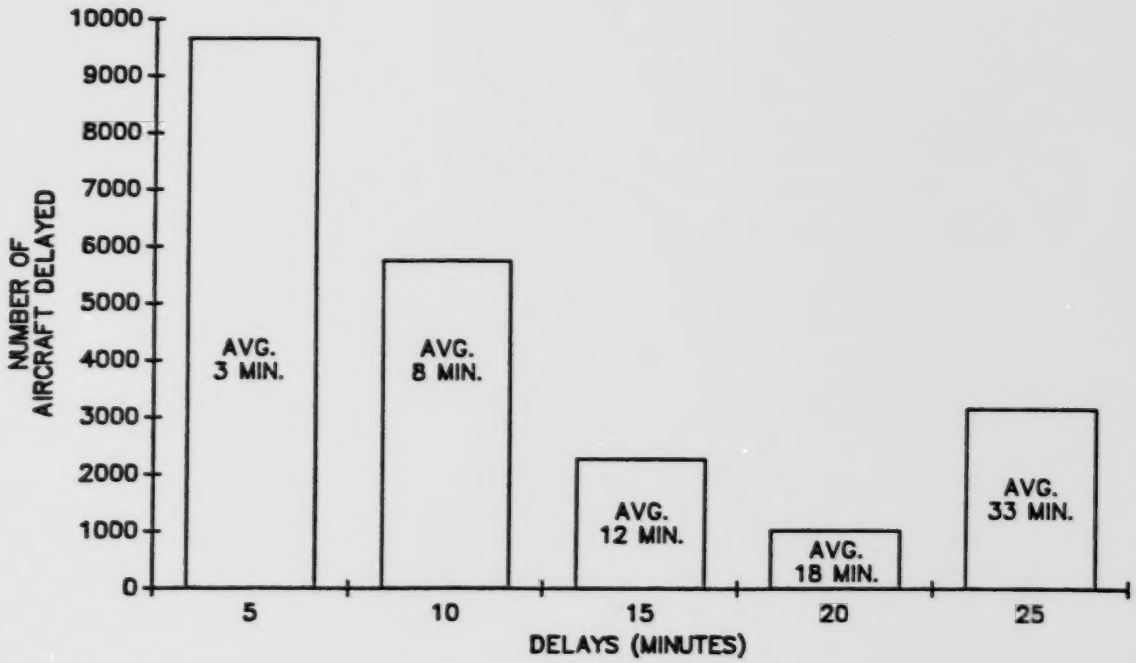


Figure I-17. Distribution of Delays Incurred 1 January - 24 May 1989 (Calculated from Transport Canada Delay Data)

The Costs of Congestion

Transport Canada has been calculating the month to month costs of congestion by examining the on-ground direct operating costs of delayed aircraft. Each delayed aircraft has a delay cost assigned to it according to the aircraft type and number of minutes of delay and these are summed to a monthly total. Over the period June 1988 to May 89, these direct operating costs to delayed departing aircraft totalled $8.6 million.

Passenger delay costs have not been included in the total. The use of passenger delay costs is a sensitive area in transportation planning. Clearly the impact of 10 million passengers delayed 30 seconds, is less than the impact of 170,000 passengers delayed 30 minutes each although the total delay time is similar. Looking at the Vancouver data, June 88 - May 89, there were 435,000 minutes of delay, of which 71% exceeded 10 minutes. If only those delays over 10 minutes are used in calculating "meaningful" passenger delay, there were still 308,850 minutes of flight delay. At an average load of 27.5 passengers per movement (considering all movements-commercial and private), the passenger delay time is 8.5 million minutes. Using an average figure of $8.50/hour (this figure was used in Transport Canada's analysis), the 12 month passenger delay cost, considering only delays over 10 minutes and only departure delays, was $1.2 million.

The longer term consequences of increased congestion are more severe. Whether through a laissez-faire approach of letting delays force the air carriers to cap or reduce flights, or through measures such as slot allocation, slot auctioning or pricing, the outcome is that the airport's movement capacity is limited, the airport becomes less desirable as a transit point or destination, and economic opportunities are foregone.

D. STEPS TO MANAGE TRAFFIC

One approach to matching demand to capacity is to manage demand so that the hourly traffic stays within the practical hourly capacity. There are a variety of methods that can be used, including:

- IFR Traffic management
- VFR Traffic management
- Traffic type restrictions
- Slot allocations or slot auctions
- Pricing mechanisms including minimum fees or peak period pricing
- Diversion
- Perimeter Rules
- Moratorium

IFR Traffic Management

IFR traffic management, or flow control, was proposed by Transport Canada and implemented in early 1989. The intent of flow control is to limit planned arrivals so that arrivals and departures do not exceed the capacity of the airport. Since the times when the airport's capacity will be reduced because of ceiling and visibility constraints are not predictable, the use of flow control often involves on-ground holds for those flights within one hour's flying time (Victoria and Nanaimo particularly). It can also involve en-route delays for inbound flights from origins further away. The primary impacts of flow control are:

- a transfer of a portion of delays to arrivals (without flow control departures bear the full delays). To the extent that the same traffic volumes exist, delays remain similar but are better balanced between departures and arrivals

- to the extent that it becomes apparent that a designed traffic "cap" is used in implementing flow control, airport users start curtailing lower value services

- a disproportionate burden is borne by short haul air carrier routes. This is already occurring. On Friday 9 June, on-ground holds were over 2 hours at Kelowna and possibly at other B.C. locations

- a small gain in the utilization of capacity as arrival times can be carefully scheduled to optimize spacing.

VFR Traffic Movement

Transport Canada has implemented a YVR Control Zone Traffic Management Program which includes:

- standardized VFR arrival and departure routes

- designated float plane and helicopter corridors

- restrictions on the use of special VFR

- termination of control zone transit operations

The impact of these steps is to put some restrictions on VFR operations, none of which would be viewed as onerous by operators that need to use the airport.

Traffic Type Restrictions

There are a variety of administrative methods used to limit traffic, with the intent generally on limiting traffic to higher value operations. These include:

- acceptance of traffic which meets a minimum approach speed only. The techniques (in place at Frankfurt and Toronto among other airports) focuses on performance to smooth out the traffic flow and thereby enhance capacity. The effect is to eliminate most piston engine and single engine aircraft from the mix.

- limitations by weight or use. Techniques along this line attempt to limit traffic to air carrier traffic either by seeking to serve only aircraft over 12,500 lbs, or by only serving commercial aircraft. (Transport Canada has gone part way along this route by recommending that priority be given to air carrier traffic of over 12,500 lb MTOW).

In reality neither of these concepts are workable. All administrative traffic type restrictions carry with them the need to designate the role of YVR in B.C. aviation. This is critical step in any case to the future of Vancouver International. There is little doubt that if, through any mechanism, traffic at YVR was restricted to a port of entry role for air carriers, there would be years of capacity with the current runway configuration. Vancouver International currently also serves as:

- the major B.C. hub for scheduled services throughout the province to link with domestic, transborder and international services

- the major Vancouver destination airport for scheduled traffic from throughout the province

- a major base for charter operations serving the province and the US Pacific Northwest.

Actions which would limit smaller aircraft (including pricing mechanisms discussed below) could change the overall role of the airport by reducing some of its current roles.

Even if YVR is to maintain all of its current roles, one area that has not been fully addressed is the need for all of the current traffic to be at YVR. Of the 269,504 runway movements in 1987, 125,000 were associated with the South side of the airport. Over 100,000 movements were by piston engine aircraft, including 45% of the traffic during the 40 worst peak periods in 1988. There are two methods for determining the need for all of this traffic to remain at YVR.

. a detailed analysis of all based aircraft by tail number to determine types of use, or

. the implementation of minimum landing fees to obtain a market assessment of the need for the traffic to be at Vancouver.

Transport Canada has attempted to examine traffic to determine uses. Figure I-17 summarizes these results. Appendix B lists the operators and estimated movements.

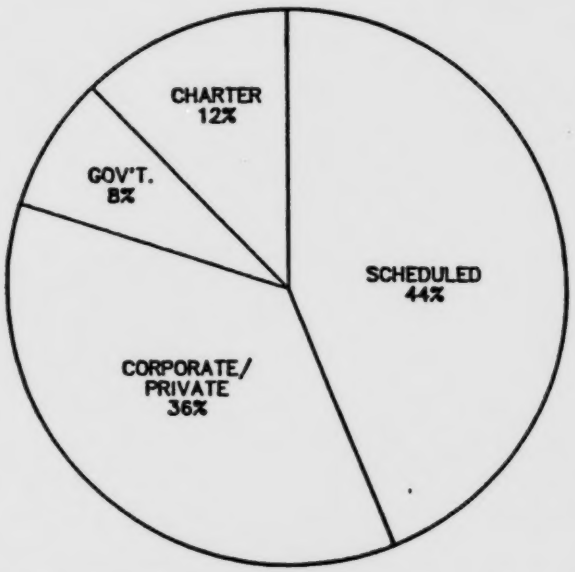


Figure I-17. Estimated Composition of South Airport Traffic 1988

The South Side Activity Study also determined that 26% - 32% of the passenger traffic (based on a June 88 sample) were transferring to or from flights using the main terminal. This figure is in the same range as the percentage connecting passengers within the main terminal; 29% as determined by the 1986 Passenger Survey.

Although the study showed a high degree of interaction between the South side and the main terminal, it also showed that approximately 70% of the passenger traffic does not connect to the main terminal, and 60-63% does not transfer at all but originates/terminates at the South Terminal. The study shows that some users have a definite need to be at YVR (and not at Boundary Bay, Pitt Meadows or Abbotsford) but does not address fully why the other users need to be located at the international airport.

While there is little doubt that some of the South side traffic can be relocated, the degree of relief provided is minimal. If it is assumed that in general terms, all the piston engined aircraft are south side traffic, then Figure I-18 gives a reasonable approximation of the impact of diverting some or all of this traffic to other airports. If none of this traffic is diverted we are at capacity today. Even if all the traffic is diverted (piston engined A/C made up 101,524 movements in 1987) the airport would once again be at capacity with the currently forecasted growth in jet and turboprop traffic by 1998. If 50% of the piston engined traffic is relocated, capacity is reached in 1992. With a three year lead time for environmental assessment and construction, the decision to expand must be made before 1995 even if all the piston engined aircraft were diverted to other airports. Assuming that at least some of the traffic has every right to be at YVR, capacity would be reached in the 1992-1995 period and the decisions to expand needs to be taken in the 1989-1992 timeframe.

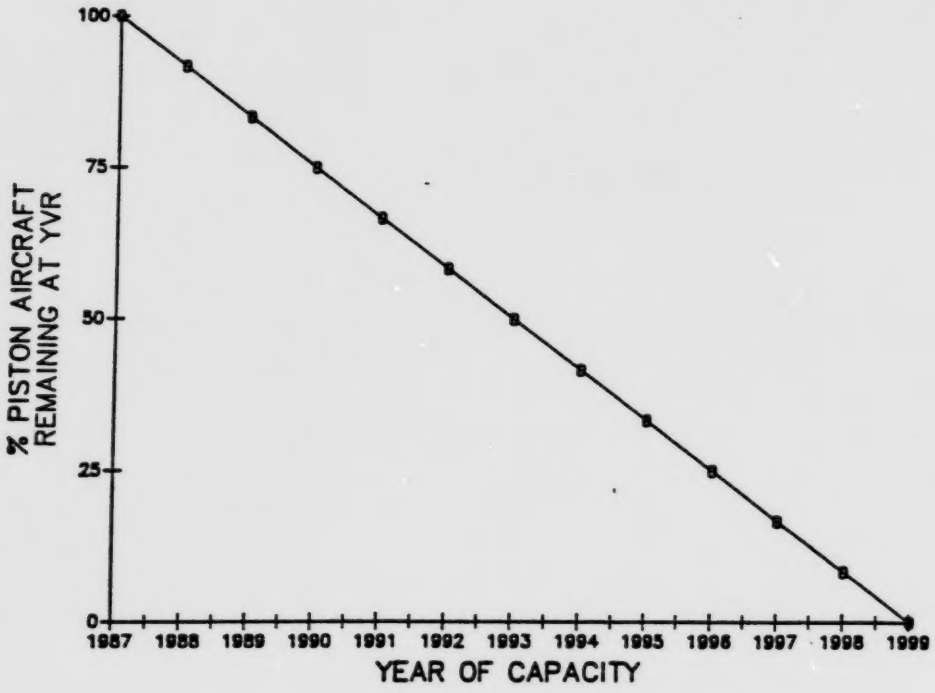


Figure I-18. Year that Capacity is Reached as a Function of the Percentage of Piston Engined Aircraft Diverted to Other Airports

Slot Allocations or Slot Auctions

Some form of slot control (arrival/departure time period allocation) has been the option of preference for the many US airports that are congested. Although there are many alternatives, there are two broad mechanisms in use:

- slot allocation whereby the airport determines the number of available slots and allocates these slots either to individual operators (based on historical use patterns) or to groups of operators (i.e. all scheduled carriers, general aviation) who determine among themselves the allocations to specific users.

- slot auctions whereby the slots are sold to users and are then fully transferable so that they tend to move towards a most valuable use. Generally some minimum number of g.a. slots or VFR slots is protected to provide some access to lower value users.

These mechanisms have worked at many sites, but the airports have tended to have all carrier traffic or near all carrier traffic before the slot controls were implemented. It is difficult to envisage how these could be successfully used in Vancouver:

- normally it is IFR slots that are controlled. Vancouver operates at a much higher number of operations normally than the IFR movement capacity because it operates with mixed IFR/VFR traffic over 93% of the time.

- these mechanisms normally focus on high passenger volume flights and could definitely lead to a curtailment of movements of under 19 seat aircraft in Vancouver. For example, it is estimated that the current trading value of a La Guardia Slot is up to $700,000. This would not be acceptable unless the role if the airport changes and the various regional services to Qualicum, Campbell River, Powell River, Terrace, Smithers, Gilles, Sechelt, Bella Bella, Bella Coola, Ocean Falls, Port Hardy etc are served at another airport.

Pricing Mechanisms

Pricing mechanisms of some form are used at many congested airports:

- Peak Period pricing whereby the landing fee related to the economic value of the "slot" during periods of congestion have been used by British Airports

- Minimum fees are used to some degree at many international airports

Peak period pricing is a favourite with economic academics, because the theory is sound; high value operations will pay the fee and other users will adjust to avoid the fee. Its success in reality has been somewhat limited. The BAA, the only committed user of peak period fees, commented in its 1976 annual report:

> "We learned from this experience that a differential in this respect [peak period landing fees] is not effective. The reason is quite clear. The landing fees are such a small proportion of an airline's total operating costs that it is not effective (unless it is a massive charge) and cannot get the people to go elsewhere".

BAA Annual Report 1976 Page 169.

In Vancouver, the results of peak period pricing could be predicted:

- the entire day until 6 PM would be designated as peak , as it is throughout this period that demand is near capacity (see Figure I-12)
- Much of the small aircraft traffic, including all the commercial traffic with aircraft under 30 seats wold be unwilling to pay
- the traffic remaining would be:
  - scheduled and charter traffic of 30 seats or more;
  - business jet traffic;
- the role of the airport would be significantly changed to an origin-destination airport, a transit point for long haul and a hub for Victoria, Nanaimo, Kelowna, and Prince George originating traffic. Traffic to and from other points would seek alternative airports.

Minimum fees do have some potential for Vancouver. Many international airports have some form of minimum fee structure, and some have had minimum fees in place for 20 or more years. Virtually all of the South side scheduled and charter traffic at Vancouver is piston engine aircraft which pay no landing fees. It is very difficult to judge the value of this traffic under the circumstances. Transport Canada's ACE team suggested a $25 minimum fee at Vancouver, and suggested that as much as 20,000 movements/year could be relocated through a combination of this minimum fee and the establishment of a flight service station and Customs facility at Boundary Bay Airport. No action has been taken to implement this fee, and estimates of the capital program required to make Boundary Bay attractive were not available.

In 1986 when the minimum fees at Kennedy Airport in New York were increased from $5.00 to $25.00 (equivalent to approximately $80.00 in 1989), general aviation was reduced by 26% over the next 5 months. A 1971 report suggested that a $100.00 minimum would eliminate general aviation users from the airport entirely.

The Australian Federal Airports Corporation is currently attempting to discourage general aviation traffic at Sydney Airport, and has proposed a minimum $100 AUS landing fee during peak periods. A preliminary assessment of the traffic mix at Vancouver would suggest that $25.00 is too low to be effective, and that a fee in the order of $100 would be needed to significantly divert traffic.

Until some form of minimum fee structure is in place at Vancouver International, it will make it difficult for the airport to argue that all reasonable avenues have been pursued, and that the new runway is the only option.

The ACE Team, in estimating the impact of the minimum fee (20,000 movements) and measures to relocate some government traffic (5,000 movements), concluded that the relief provided would contribute one year of growth potential and does not in any way provide a solution to the congestion problem.

Diversion

Diversion of traffic to other modes or other airports can be a result of administrative action, pricing actions or market mechanisms. The potential for diversion of air movements to Boundary Bay Airport has already been discussed. Other potential diversions include:

- high speed surface links from YVR to Victoria and Nanaimo
- expanded uses of helicopter or tiltrotor on B.C. routes.

The potential for a high speed downtown Victoria to downtown Vancouver surface link (ocean catamaran, Jet Foil, Hovercraft etc) has been explored on numerous occasions. It does not appear that the option used from Malmo, Sweden to Copenhagen Airport in Denmark of using an airport to airport surface link operated as a flight and ticketed as a flight has been fully examined. A YVR to Pat Bay Airport ocean catamaran would make the crossing in 1 hour. A YVR to downtown Victoria trip would require approximately 2 hours.

Helicopter services, whether airport to airport, airport to downtown, or downtown to downtown do not use the runways. Currently available helicopter types would permit up to 50 seat helicopters to be used YVR-Victoria and YVR Nanaimo. Barriers to expansion of the airport-downtown services appear to be:

- the lack of joint fares with Air Canada and Canadian, and the difficulty in obtaining joint fares with these two carriers owning commuter airline subsidiaries
- the low level of landing fees which makes the helicopter less price competitive.

The introduction of tiltrotor, if it was to be brought into service by one or both of Air B.C. and Time Air could dramatically relieve runway congestion at Vancouver. The tiltrotor is a vertical take-off aircraft integrating the vertical capabilities of the helicopter with the high speed cruise of an airplane. There is currently a military prototype flying, and civil deliveries are tentatively scheduled for 1999-2000. A commonly envisioned configuration is a 44 passenger version with a 315 mph cruise speed and a range of 350 miles to 500 miles. Figure I-19 illustrates a civilian tiltrotor concept.

Alaskan operators feel that it will revolutionize coastal and mountain aviation. Clearly B.C. will be one of the highest potential market areas for tiltrotor and its introduction on B.C. routes would significantly reduce congestion at YVR. Equally clearly, however, is that it would not be available in significant numbers until 2003-2006, and will not be in use early enough to address the capacity shortfall at Vancouver International Airport.

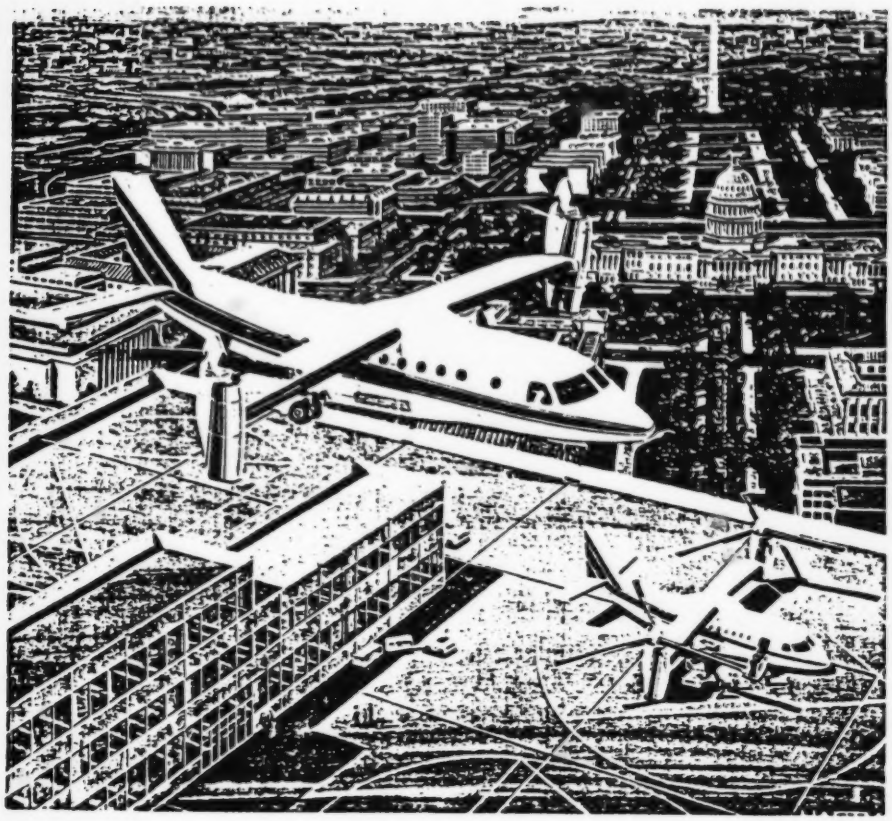


Figure I-19. Concept For Civilian Tiltrotor (R&W1 Tiltrotor Vol. 1 No. 2)

Perimeter Rules

Some airports have responded to congestion problems by restricting operations to particular destinations. Both La Guardia and Washington National are subject to rules which limit all long haul flights. These operations are accommodated at other airports.

Major distortions can result. One airline, unable to operate a Washington National - Dallas service, made an enroute stop at the nearby Dulles field. This expensive strategy defeated the purpose of the perimeter rule. Air Canada attempted to develop a Vancouver-Calgary-New York La Guardia service in the early 80's. However, perimeter restrictions ruled out a La Guardia-Calgary nonstop flight. The flight was shifted to the Kennedy and, eventually, Newark airports. However, this impediment could not be overcome, and Air Canada has now virtually abandoned an important service to Western Canada.

Since there is no Lower Mainland alternative to the Vancouver International Airport, a perimeter rule would be unworkable. Vancouver International must remain open to new long distance services if it to retain a role as a Pacific gateway. A reverse perimeter rule, in which short haul services were barred, would discriminate against interior and coastal communities. Regional services must continue to connect with domestic long distance flights.

A modified domestic perimeter rule could bar nonstop services on some long haul Canadian routes. However, most communities now capable of supporting nonstop flights to VIA currently are served. Since existing flights would presumably be allowed through a grandfather clause, the perimeter rule would rarely be binding. If nonstop services to certain cities are to be barred, the selection process will be emotionally charged and highly political. Moreover, this strategy utterly defeats the aim of enhancing Vancouver's Pacific services through the development of traffic feed from the hinterland.

The implementation of perimeter rules can be difficult and controversial. They are inherently arbitrary. Long distance passengers will be denied nonstop services. When these persons are accommodated on multi-leg short haul services, the quality of service provided to the short haul passenger may suffer as well. Timings of intercity departures may now reflect the needs of long haul services, and the airline may preferentially sell seats on intercity services to long distance passengers.

Moratorium

In the late 70's and early 80's, Transport Canada placed a moratorium on new international services to Toronto. This was prompted by growing fears of groundside congestion. This prevented several airlines from serving Toronto, and forced many passengers to transit the Mirabel Airport or gateways in the United States.

The Toronto moratorium was eventually relaxed. Airlines were allowed to begin flights to Toronto at "offpeak" times, provided that equivalent services were offered at Mirabel. Since international long haul services have rather inflexible scheduling needs, and services to two Canadian airports would be superfluous, the revised ruling continued to constrain international traffic growth at Toronto.

If Vancouver cannot process the traffic of incumbent airlines, a moratorium might be considered by the federal government. It would most likely prevent new Asian carriers from serving Vancouver, and would directly counter any move to develop the local trans Pacific air trade.

If applied to Vancouver, a moratorium could specify certain operating times for new international services. New trans Pacific carriers could be denied timings in the critical early-afternoon period. While departures in the late evening, with morning arrivals in the Orient could be marketable, this constraint could nevertheless discourage new carriers from establishing services to Vancouver.

Vancouver should ensure that the Toronto Moratorium is not used as a precedent in its own efforts to solve the capacity problem.

E. CAPACITY ENHANCEMENTS

Initiatives to increase capacity include:

- increased use of runway 12 through noise abatement waivers for stage 3 aircraft, and through simultaneous IFR approaches on 12 and 08
- modifications to standard instrument departures
- minor airfield modifications including high speed runway exits and entries and an apron by-pass (see Figure I-20)
- use of a stub runway. Taxiway alpha on the South side is adequate for use as a runway by light piston aircraft. Up to 9 takeoffs an hour can be handled (see Figure I-20)
- decreased spacing of arriving aircraft
- technological improvements to air traffic control
- a new parallel runway to 08-26.

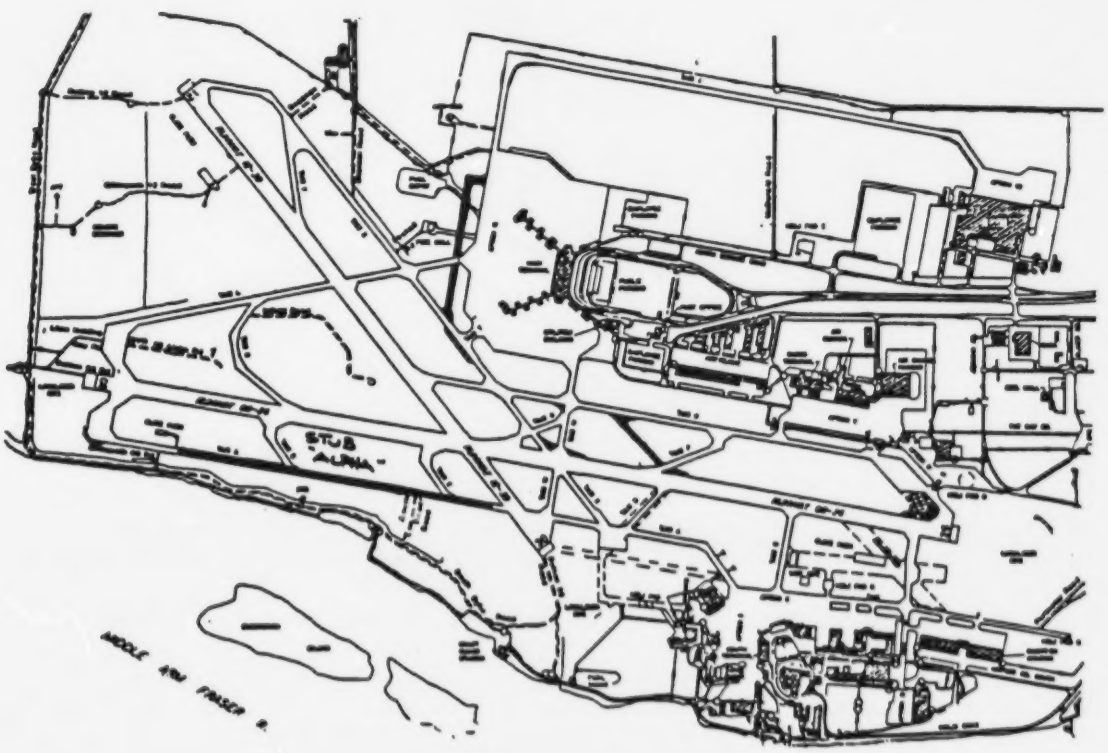


Figure I-20. Planned Airfield Capacity Enhancement

Transport Canada has implemented or is implementing the first four of the initiatives listed above. The estimated capacity impact of these modifications is to increase the hourly practical capacity from 59.3 movements/hour to 64.2 movements/hour, and to increase the annual practical capacity from 277,000 to 300,000 movements, an 8% increase.

Spacing of Aircraft

Transport Canada currently operates so that the planned arrival spacing of aircraft under IMC conditions is 3 miles (nm). The US FAA has reduced this limitation for operations on dry runways to 2 1/2 nm and is currently carrying out trials in Atlanta on wet runways at 2 1/2 nm. A decision on the widespread use of 2 1/2 nm on wet runways is expected in August 1990. The use of 2 1/2 nm in Canada would increase IFR capacity. Because spacing already varies, it would not provide the full 16% theoretical gain that an examination of the numbers would indicate, but gains in IFR capacity in the 8% to 10% range should be achievable.

Technological Improvements to Capacity

A number of technology improvements are being planned and/or implemented in Canada and Vancouver can expect to benefit from these. Under the aegis of the Canadian Airspace Systems Plan the following new systems/technologies for ATC are envisaged.

1. RAMP (radar)
2. RAMP (display equipment)
3. Canadian Automated Air Traffic System (CAATS)
4. Microwave Landing System (MLS)
5. SSR Model S/Data Link
6. Rapid Scan Radar

Other technology developments are being evaluated in the USA and other countries. In the USA the Airport Surface Traffic Automation (ASTA) and Terminal Air Traffic Control Automation (TATCA) projects are being developed. In addition new concepts in the use of secondary surveillance radar are being evaluated, such as high speed electronic scanning.

The foregoing technology improvements are discussed in the following paragraphs and comment is offered relating to their effect on runway capacity and the timescale for implementation.

Radar Modernization Program (RAMP) - Radar

Under this program Vancouver Airport will be provided with a new solid state radar system consisting of an L-band primary radar (PSR) with 120 nm range and co-located monopulse SSR (MSSR) with 200 nm range. The primary radar will have very good performance under precipitation conditions. The MSSR will provide higher positional and tracking accuracy than is possible at present and will virtually put an end to the problems caused by garbling and false returns.

The effect of this radar performance improvement is hard to quantify since to date, only two densely trafficked countries have completely converted to MSSR, the United Kingdom and Switzerland. Like Canada, other countries such as the USA and France are in the process of changing. However, it is a fact that at Geneva, where terminal controllers were greatly handicapped by the effects of mountainous terrain on conventional SSR, the effect of MSSR has been dramatic. Likewise, in the UK greater controller confidence in MSSR data has been reported. It is possible to state therefore that controller productivity may be improved and minimum separations more generally used with the advent of RAMP radar. Thus if there is currently some under-utilized runway capacity at Vancouver due to lack of the new radar, then some small capacity gain may be expected. It would be unwise however, to expect more than a 5% improvement and it should be remembered that radar is most valuable in IMC, when much of the VFR GA traffic at Vancouver could not operate in any case. Implementation at Vancouver is expected in 1991.

Ramp - Display Site Equipment (DSE)

This program will provide Vancouver tower with daylight viewing displays which will indicate not only the position of aircraft but also their identity, altitude, speed and short track history.

There is probably no doubt that this will allow tower controllers to make more rapid and accurate decisions with regard to spacing of aircraft, final approach sequencing (for VFR and VFR vs IFR) and take-off releases. When the ARTS 3 system with similar displays was introduced at busy airports in the United States there was certainly a positive reaction from tower controllers. It could therefore be expected that some capacity gain may result, but again, as with the radar, this is not likely to be dramatic and until the system is installed and in use it would be unwise to assume more than a possible two or three percent capacity improvement. Installation in Vancouver is expected in 1991.

CAATS

CAATS is a national system with a particular emphasis on data processing, communications and new common controller workstations (CCWS). The effect of CAATS will be to provide more accurate data, very rapidly, to and between controllers across the country. Equipment will be provided to towers, terminal control units and area control centres. The new workstations are expected to increase controller productivity. However, CAATS is an airspace oriented system which cannot, of itself produce any significant gains in runway capacity unless there is already considerable under-utilization of runways due to poor airspace management. CAATS is expected to provide better metering and airspace management, so it is possible that runway capacity gains may result by ensuring the closest possible separations between arriving, departing, and arriving/departing traffic. Nevertheless, such possible gains have only been estimated under simulated conditions, since no country has yet implemented an advanced ATC automation systems (AAS). The USA awarded a contract for its AAS late in 1988.

Studies by the MITRE Corporation have indicated that automation and technology advances could yield significant increases in capacity. Figures ranging from approximately 15 to 40 percent have been quoted. Care must be taken when reviewing such evaluations and simulations, since a simulation may indicate significant airspace capacity increases but it is not always clear whether the runway capacity serving the airspace has been fully taken into account. The US FAA TATCA project addresses the runway question. This project is dealt with in a later paragraph.

CAATS tenders are still under evaluation and a contract award is unlikely before late 1989 or early 1990, provided cabinet approval is given. The project is large with a very heavy software load and it must be assumed that there is some risk to the proposed implementation date of 1995. It is therefore felt that it would be unwise to pre-suppose any CAATS benefits at this stage, since this might leave the airport critically short of runway capacity in the mid to late 1990's if benefits from CAATS were to be pre-supposed and then not materialize.

Microwave Landing System (MLS)

Improvements in the terminal/approach traffic handling capability/capacity are expected with the implementation of MLS, which is expected on Runway 08 in 1991 and Runways 26 and 12 between 1995 and 1998. There has been no call for tenders for the initial Transport Canada MLS program, which could affect the 1991 date.

MLS may be more flexible than the aircraft which will use it. MLS, with its ability to accommodate steep glide slope angles, curved approaches and short final approaches is ideally suited to STOL aircraft such as the DHC Dash 8 and similar aircraft. However, large heavy jet transport aircraft have maneuvering performance limitations which preclude steep glide paths and high rate turns in the approach configurations close to the runway. In addition, the random approaches permitted by MLS may conflict with noise abatement procedures. Therefore, when pre-supposing capacity gains from MLS, the figures should be viewed with caution and initially it would probably be unwise to assume a potential capacity increase in excess of 5%.

SSR Mode S/Data Link

This project, which would provide a computer/controller to flight deck digital data link has not yet been funded or specified. However, the TCAS program in the USA is expected to add some impetus to it.

If implemented (tentative dates 1994-2000) it should improve surveillance quality and reduce controller/pilot voice communication workload. Mode S does not necessarily mean greater accuracy than monopulse SSR without Mode S (i.e. RAMP). In fact introduction of data link messages could slightly reduce MSSR accuracy.

It is probably too early to seriously quantify any possible runway capacity gains from Mode S and there is still some debate in industry whether SSR is the right medium for data link, given the availability of VHF and Satellite ACARS/AIRCOM (data link using the SITA and ARINC VNF network or proposed satellite system).

Rapid Scan Radar

This possibility is still in the study stage with some work being done in the USA and UK. Although mechanically rotated radar antennas can be used at high rotation rates there are severe limitations and rotation of a conventional MSSR LVA antenna at much more than 20 rpm becomes progressively less feasible due to size and weight of the antenna and its turning gear. Current mechanical high speed scan antennas are used only for the X band and higher surface movement radars.

Studies and experiments are being carried out with electronically scanned antennas. Currently it is difficult to provide the required accuracy at reasonable cost, but it is likely that in due course electronically scanned antennas will replace mechanical turning gears. High scan speeds will be possible and this will provide the high accuracy required for progressively lower separation minima between aircraft. At the moment however, no timetable or scale of benefit can be given.

Terminal Air Traffic Control Automation (TATCA)

This FAA program commenced in 1987 and is being carried out a Lincoln Laboratories, Lexington, Mass.

The project involves work on time based planning for the terminal area. The airspace involved is a circle of 200 nm around the airport. The intent is to develop a time based flight plan to bring aircraft from beyond top of descent (TOD) to the threshold.

Previous work had been done by NASA-Ames in the USA and in Germany, where it is already in use for Frankfurt (COMPAS) and is apparently working well. It reduces the number of speed changes in the terminal area since en-route and terminal controllers are all working to the same plan. The FAA will add top of descent and turn to final advisories and the whole project is focussed on getting the right sequence, taking into account wake vortex, aircraft type and weight, spacing and metering. The early simulations at Lincoln Laboratories have shown that for Boston a 20% to 33% capacity increase could be expected for a single runway. The Project Manager advises that it is a highly software driven project, programmed in "C", using a very capable engineering workstation, interfaced in parallel to the existing ARTS 3A system. Data (Flight Plan, Radar etc) will be acquired form existing systems. The output to the controller will be on an auxiliary display plus a supervisor display. In due course the system would be transported into the new ASS, but it is expected that it would be some years before this happens. It would also connect with Mode S and Data Link.

Prior to field implementation, it has to be confirmed that a valid requirement still exists in the context of the NAS plan. There is therefore no implementation data available.

The United Kingdom CAA is so interested in this development that their Chief Scientist will visit Lincoln Labs in August 1989 to evaluate the system.

Overall Impact

Overall, it appears that technology will increase the IMC capacity by 25-35%, which would bring the IMC capacity up to a level much closer to the VMC capacity (approximately 18% below VMC capacity versus the current 39% below VMC capacity). The effect in Vancouver would be a limited overall capacity gain of approximately 5,000 - 30,000 movements/year.

In any case, the benefits of these technology gains will not be fully felt until 1997-2000, too late to address the immediate capacity problems at Vancouver.

New Parallel Runway

A new parallel runway, as illustrated in Figure I-21 would increase the practical hourly capacity to 108.1 and the practical annual capacity to 505,000 movements per year with the current traffic mix of IFR/VFR and heavy, medium and light aircraft. As the percentage of IFR traffic increases (it is forecast to increase to 75% in 1996 from the current 60%) the capacity available will decline to 350,000 - 460,000, depending on the traffic mix and flexibility in the use of runways. This same decline in capacity will unfold on the existing single runway, so that by 1996 the capacity even with improvements will be 210,000 - 260,000 for the forecast mix of aircraft. Depending on the mix of traffic and restrictions on runway use, a new parallel runway would add 140,000 - 200,000 movements/year incremental capacity - a gain of 66% to 77%.

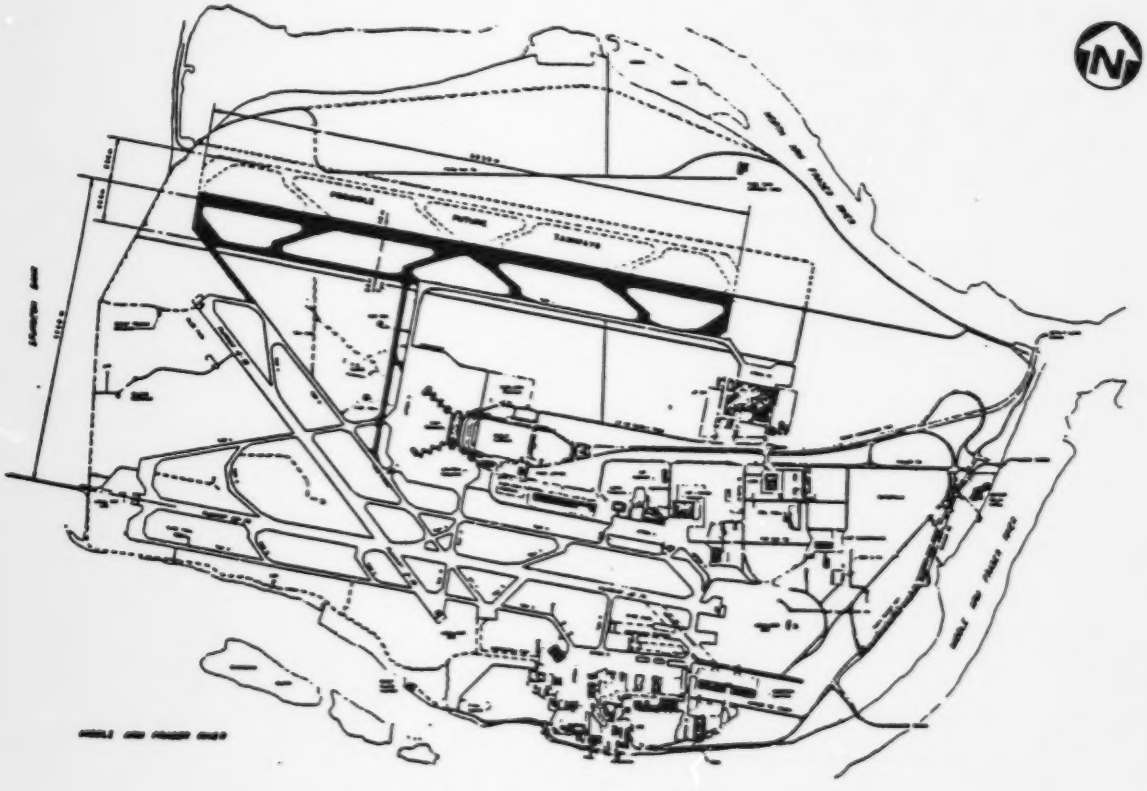


Figure I-21. YVR Location of New Parallel Runway

F. BALANCED SYSTEM CAPACITY

An airport is typically thought of as three systems:

- groundside (roads, parking, curbarea)
- terminal building
- airside (runways, taxiways, aprons)

The intent of effective planning is to keep these three elements somewhat in balance in terms of capacity: that is, that the ability of the terminal, and groundside systems to process passengers should relate to the ability of the airside system to deliver the passengers.

Vancouver International Airport is reasonably well balanced in its present configuration, but aircraft gates are reaching capacity. If continued growth is provided for through a parallel runway, then additional terminal capacity (and possibly additional vehicle parking) will be required at the same time. Put more strongly, there is no point building a parallel runway without simultaneously building additional gate/terminal capacity. By 1993, Vancouver International is expected to need:

- 4 additional domestic jet gates, and 3 commuter gates
- 1 new transborder gate (needed in 1989) and 8 additional transborder gates through development of a North East Finger.

By 2001, forecasts indicate that the Airport should have:

- 3 more commuter gates
- 10 more jet gates.

G. THE PROPOSED CAPITAL PLAN

Runway

Transport Canada has based its capital costs for the parallel runway on construction of a 9940 foot runway. Total estimated costs are $78 million in 1992 dollars.

A copy of some of the design information (H.A. Simmons (International) Ltd. "Proposed Third Runway Conceptual Design and Construction Program") was provided to this study team. Estimates were not provided. Key points with respect to the runway construction are:

- a preload of 3 metres of sand for an 8-12 month period is the recommended approach to consolidating the sub surface material. Dredged material is recommended for this preload. If dredged material is used, it may be necessary to construct silt control ponds. It may also be necessary to install a dust control system on the preload using sprinklers.

To provide an overview of the composition of the $78 million cost, and to carry out a quick cross check on the overall magnitude, the study team carried out its own estimate (Table I-3 below)

Table I-3. Estimate of Capital Costs for a 9940 ft Runway at Vancouver International Airport

	(1992$)
Site Prep, Fencing, Landscaping	2.9 M
Preloading (including material)	2.7 M
Grading, Base, Pavement	25.6 M
Roads	4.2 M
Visual Aids (Lighting, Vasis, causeway)	8.0 M
Navaids	3.8 M
Utilities	5.9 M
Environmental Protection	1.0 M
Misc.	1.3 M
Design, Supervision, etc.	15.5 M
Contingencies	7.1 M
TOTAL	$78.0 M

Terminal

Estimates were provided for the terminal development to 1993 (1992 $):

- new domestic gates	$ 25.5 M
- New transborder gates/NE finger	$ 113.5 M
	$ 139.0 M

No estimates were provided of the additional terminal requirements to 2001, but it is estimated that the additional gates required would cost $50 million - $80 million (1989$), or approximately $86 million in 2001 dollars.

II THE ENVIRONMENTAL IMPACT

All major federal projects are subjected to a formal Environmental Assessment and Review Process (EARP). With several previous examinations of a potential parallel runway at Vancouver, the terms of reference for the process are well established. An EARP panel was established in 1976, (it reached the point of public hearings in 1977), and again in 1983. The 1983 panel reviewed and revised the guidelines developed by the 1976 panel. The 1983 panel was stood down and it is expected that this panel will simply be recalled to administer and overview the process.

The output from the EARP process is an Environmental Impact Statement (EIS). The 1983 EARP Panel designed the terms of reference for the EIS and it is anticipated that the EIS which will be a necessary part of the current examination of the runway issue will by very similar in content. The terms of reference in 1983 required that the EIS address:

- the history of the third runway issue
- the geographical and ecological setting, with specific reference to areas affected by noise, changes in land use, transportation patterns, public access and the natural environment of Sea Island and the Strait of Georgia (including fish and bird habitat)
- the aviation setting including all area airports, forecasts by market (specifically linked to the origin-destination in question), required facilities for various air traffic types, the capacities of facilities, and the allocation of traffic to other lower mainland airports (capacities/capabilities of these airports to handle traffic)
- project justification, to include a full and conscientious analysis of the need, and;
  - an analysis of the segments of the Vancouver community that use the airport
  - an analysis of the economic importance of Vancouver International Airport
  - an analysis of Transport Canada's policies which are relevant to the third runway proposal.
  - an examination of alternatives to the runway including:
    - do nothing
    - better use of existing airports
    - alternative designs
    - aircraft type separation (ie. a small 5,000 runway for use only by light A/C)
    - diversion of in-transit, charter or freight carriers
    - modifications of flight operations
    - enhancements of ATC
    - peak hour spreading
- a comprehensive description of the project for preconstruction, construction and rehabilitation phases, including: plans for the land north of the proposed runway; construction period activities, plans, location of dredgeates
- operational scenarios for the new runway; forecast use of each runway by aircraft type under various operating conditions
- a detailed land use plan for Airport North with environmental management plans
- analysis of the impacts of the construction phase including dredging; transport of dredgeate; storage sites

- an examination of whether any of the construction activities conflict with the proposed policies and programs identified in the Fraser River Estuary Study

- an analysis of the impact of changes in airport operations on human and wildlife populations, including:

  - incremental changes to noise levels
  - noise impacts (including the most current research on these impacts)
  - noise mitigation measures and residual impact
  - land value impacts
  - impacts on birds and bird habitat and mitigation steps
  - impacts on land use planning in the area and future restraints on land use
  - impacts on recreation including noise, fumes, water quality and mitigation measures
  - impact on surface transportation needs and the need for transit service to the airport
  - dangerous waste disposal plans
  - impacts on fish and fisheries

- an identification of all mitigation and or compensation options

- an identification of all impact monitoring measures.

The EARP Panel will be reconstituted in late summer or early fall 1989 and will be chaired by the same chairman as the 1983 panel. There is every reason to believe that the same scope will be included and that project justification will be addressed. The Federal government is highly sensitized in this area and is unlikely to take any action which could be interpreted as shortcuts. Transport Canada have been taking measures to ensure that the studies have been done to address all environmental issues:

- the detailed noise analysis will be completed by mid June 1989.

- a detailed study of the bird use of Sea Island has been completed which indicates that 85% of the bird habitat is in the offshore wetlands and that all of N. Sea Island inside the dykes only provides 15% of the habitat. Barn owls, hawks and eagles are the outstanding issues. The Federal Department of Public Works is investigating the purchase of offsetting property to reserve for bird habitat.

- automated storm water quality systems will be installed this year. These systems monitor water quality in the main outflows from Sea Island and close these outflows if the quality deteriorates below preset levels

- environmental agencies, groups and municipalities in the area have been contacted and the environmental issues discussed. The press has been briefed.

With some remaining justification issues that are being currently worked on, Transport Canada should be well positioned to fully address the EARP terms of reference.

The initiation of the EARP is currently delayed while a final determination is made whether the project justification will or will not be included in the terms of reference. This decision is to be made by the Federal Ministry of Transport in consultation with the Federal Minister of Environment. Given recent court decisions and the current importance of environmental issues, it is expected that the EARP will be very broad and will not be limited to purely environmental issues.

III ECONOMIC CASE FOR GROWTH

A. LOCAL ECONOMIC IMPACT OF YVR

In a 1986 local impact study, it was determined that the Airport contributed fully $1.4 billion per year in Gross Domestic Product in 1985.[1] By 1987, this had increased to $1.5 billion per year.[2] The GDP contribution is expected to rise to $4 billion by 2001. The Airport generated direct, indirect and induced employment for 29,000 person-years in 1985.[1] By 1987, this had increased to 31,000 person-years.[2] The 1986 study forecast that this would grow to 46,000 by the 2001 horizon. Replacement costs for the facility, in 1985 constant dollars, were estimated at $1.5 billion. This had grown to $1.7 billion by 1987. The Airport plays only a minor role, if any, on depressing the value of adjacent residential land.[1]

The South Side of the Airport, with large General Aviation activity contributes 10% of the total contribution to output and 12% of employment. The current replacement cost is $100 million.[3]

The contribution of the Vancouver International Airport to Provincial Gross Domestic Product is comparable to that of Agriculture/Fishing ($1.2 billion in 1987), Forestry ($1.5 billion in 1987) or Mining ($1.6 billion in 1987). The Airport accounts for 2% of total Provincial employment.[1]

These findings suggest that the British Columbia community should take an active and ongoing interest in matters affecting the Airport. It cannot afford to have airport and air services development thwarted by serious regulatory, institutional or physical capacity constraints.

If the traffic at Vancouver is capped either through the impact of congestion or through measures to control demand, the economic impact will be significant. The specific impact will vary according to the actions taken, but will remain substantial regardless of the approach. Whether through a laissez-faire approach, or through demand management the consequences will be distortion of markets and lost opportunities for B.C. Each of the approaches is examined below.

B. AVIATION IMPACTS OF CONSTRAINTS TO GROWTH

Higher Costs and Fares

Under these conditions, aircraft delays will rapidly reach an intolerable level. As the Airport exceeds its practical capacity by a progressively larger number of movements, delays will mount exponentially. In response to growing delays, carriers will build additional slack into their schedules. Operating budgets will be

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1 Stanley Associates "Vancouver International Airport - Economic Impact Study", July 1986

2 IMC "Vancouver International Airport - Economic Impact Study Update", May 1989

3 IMC "Vancouver International Airport - South Side Activity Study", August 1988

modified to reflect the higher costs resulting from additional fuel burn, hourly flight crew expenses, and poorer aircraft utilization. On occasion, passenger or cargo payloads may be restricted. Extra fuel will be boarded as a contingency, and the resulting increase in gross takeoff weights will drive up costs still further. With a competitive market, cost increases will eventually be passed on to customers in the form of higher ticket prices.

Shortage of Gates

Vancouver already suffers from a shortage of gates. Various interim measurers are being implemented to increase operational flexibility, and long term plans call for a major expansion of the air terminal building. The shortage of gates may be exacerbated by insufficient runway capacity.

Growing departure delays may result in higher or more unpredictable gate occupancy times. Gate utilization may suffer, and this will translate into a decline in the effective number of gates at the Air Terminal Building. Carriers wishing to inaugurate services to Vancouver may find themselves hampered by gate constraints. The availability of gates has proven to be a major barrier to carriers contemplating network expansion in the post deregulation era. Through expanding the strategic position of incumbents, it can exacerbate any trends toward an industry duopoly or oligopoly.

Changes in Airline Scheduling Practices

Airlines might attempt to deploy larger aircraft as a means to reduce total movements. Frequencies on many major routes would be cut. The most likely routes from Vancouver to be so affected would include British Columbia coastal services and flights to Edmonton, Calgary and Toronto. These services already operate at high frequencies. The resulting schedules would be considerably less convenient to travellers and could result eventually in reduced passenger volumes. Companies would likely eliminate many nonstop services altogether, particularly on long, thin routes operated by smaller aircraft. Sectors likely to lose nonstop services could include Vancouver to Montreal, Ottawa, Regina and Saskatoon.

Loss of Domestic Hub Role

Vancouver has established itself as a major domestic hub. The city also processes much of the traffic between Western Canada and the U.S. Pacific Northwest. Hub cities have stringent requirements for airside capacity. A parallel runway system is considered an important criterion for the selection of hubs in the United States. Nashville's decision to build a parallel runway was a critical factor in prompting American Airlines to establish a major hub at that airport. As airside constraints become increasingly severe at Vancouver, other cities will challenge its role as a hub. Both Calgary and Edmonton are fully capable of serving as connecting hubs for the Yukon and the British Columbia interior, and could also serve as hubs for most of the traffic originating in Victoria. As aircraft such as the Regional Jet spur development of services on long and thin sectors, the two Alberta cities will become increasingly competitive as hubs for coastal communities. Vancouver could lose much of its regional activity if its domestic hub role is undermined.

Impact on Commuter Operators

The short stage lengths of regional operators make them particularly vulnerable to runway congestion. Since a given aircraft may transit Vancouver several times each day, the cumulative effect on its productivity can be severe. The operator will require a larger fleet to service its traffic than otherwise. Operating costs, and fares, will be higher as a result. Carriers will most likely attempt to raise fares on non-competitive routes; thus smaller and more remote communities will bear the brunt of this problem.

Loss of Western Canada - U.S Pacific Northwest Transit Traffic

Traffic from Western Canada to the U.S. Pacific Northwest is particularly vulnerable. Services from both Calgary and Edmonton to Spokane are permitted by the Canada-U.S bilateral. This route is well positioned to capture much of the traffic from Canada to Washington and Oregon that now moves through Vancouver. Since Canadian Airlines International operates both Western Canada-Vancouver and Vancouver-Seattle flights, it is especially vulnerable to this diversion. With its maintenance and operations base in Vancouver, any loss of traffic by CAIL, whether or not it involves Vancouver, translates into an immediate loss to the Lower Mainland.

Diversion of Long Haul Domestic Traffic

The negotiation of a new Scheduled Services Agreement with the United States remains stalled because of Canada's perceptions of an unfair division of spoils. Canada has so far sought in vain a formula that would restore a competitive balance in a manner acceptable to the United States. When a new bilateral is negotiated in the early 90's, it will likely be in the liberal spirit that has characterized the philosophies of both nations. It will likely include some variation of an Open Skies-type of formula, in which airlines have relatively free access to any transborder route. Cabotage rights (the ability of an airline of one nation to carry strictly domestic traffic of the other country) is unlikely. Should Vancouver be subject to serious airside capacity constraints, aggressive U.S carriers could siphon considerable traffic through nearby airports in the State of Washington. They might succeed in operating eg. Bellingham-Toronto or Calgary services, ostensibly as transborder flights, but merely diverting domestic traffic from Vancouver. Bellingham traffic has recently been growing dramatically as a result of lower fares and Vancouver congestion. Bellingham is undergoing a significant expansion targeted at diverting Vancouver and Seattle passengers. Continuation of this pattern will be detrimental both to the Vancouver International Airport and to the airlines of Canada.

Encroachment of U.S Commuter Operators in the British Columbia Interior

From the British Columbia hinterland communities, regional services to airports in the State of Washington are both operationally feasible and permitted under the Canada-United States bilateral. Much of the transborder and international traffic which now hubs through Vancouver could be captured by Seattle, Portland and Spokane. Commuter operators of the United States, tied into the marketing strategies of the majors through marketing alliances, are best qualified to develop traffic feed from the British Columbia interior. Their alliances with the majors facilitate through fares from British Columbia to cities throughout the United States, coordinated schedules, and favourable displays on computer reservations screens in travel agencies. These operators not only would reduce traffic now being routed through Vancouver; they would also result in the loss of business by commuter airlines employing large numbers of British Columbia residents and purchasing large quantities of goods and services locally.

Foregone Alberta-Vancouver-California Services

The Alberta-California flights by airlines of the United States are permitted to make enroute stops in Vancouver, although none presently do so. The direct flights from Alberta have diverted traffic which would otherwise have flown through Vancouver. As the only carrier able to offer single airline Alberta-Vancouver-California connecting services, Canadian Airlines International has been particularly hard hit by the Alberta flights. It is a major employer in the lower Mainland. The Alberta-Vancouver-California sectors operated by a U.S carrier could partially offset the damage to British Columbia resulting from the direct Alberta-California route. It would stimulate both Vancouver-California traffic and airline employment at the Vancouver International Airport. This opportunity cannot be considered if the Vancouver Airport is encumbered by a growing airside capacity shortfall.

Diversion of Atlantic Traffic to Alberta

On trans Atlantic routes, Vancouver is already competing intensely with Edmonton and Calgary. Nearly every flight from Western Canada to Europe now originates in Vancouver and enjoys stopover rights at airports in Alberta. Alberta airports are relatively uncongested, and are benefiting from the growing popularity of the Rocky Mountains as an international tourist attraction. Should delays at Vancouver become more serious, carriers might truncate some flights in Alberta.

Diversion of Canada-Orient Traffic To Competing Airports

Services from Vancouver to the Orient could be harmed in a particularly serious manner. Much of the traffic from the Canadian interior to the Far East now transits U.S West Coast airports. Capacity from these airports is growing rapidly. American carriers on the Pacific, particularly Delta, Northwest, American and United (particularly if the latter two carriers' requests for Chicago-Tokyo authority is granted) are increasingly able to integrate their transborder and trans Pacific markets, while Air Canada remains active in soliciting connection traffic through Los Angeles and San Francisco. If, as a result of delays, the Vancouver Airport becomes difficult or expensive to serve, carriers may be reluctant to add additional trans Pacific capacity through Vancouver.

The proximity of Seattle, and its aggressiveness in attracting traffic make it a strong competitor to Vancouver. If Vancouver cannot cope with long haul traffic, Seattle will, and the employment associated with a growing airport will occur in Seattle instead of Vancouver.

Loss of Services to Low Volume Destinations in Orient

The city of Vancouver, despite growing economic links with the Orient, has insufficient locally originating traffic to support high frequency (at least 3 weekly) wide body services to most Asian destinations. It must rely heavily on connecting traffic from eastern Canada, and therefore must compete with numerous other possible gateways including New York, Seattle, San Francisco, Detroit, Chicago and Minneapolis. These airports already enjoy considerable nonstop capacity to the Pacific and the progressive arrival of the 747-400 will only strengthen their advantages over Vancouver. In many cases, they are already closer to the Toronto-Tokyo Great Circle route than is Vancouver. An Oriental carrier serving both Vancouver and gateways in the interior will attempt to maximize the length of its haul through routing Canada-bound traffic through airports other than Vancouver. While Vancouver would likely retain most of its locally originating traffic, the loss of feed from the hinterland would necessitate a severe cutback in capacities and flight frequencies. Canadian Airlines International would be especially hard hit by the loss of backup traffic and, more than any other carrier, would be forced to reduce its total scale of operations. Because of its large presence at the Vancouver Airport, local employment repercussions could be severe.

Canadian Airlines International, Korean Air and Air China now operate several Toronto-Vancouver-Orient services. Traffic from Vancouver alone is unable to support services to many Asian cities. It is sometimes necessary to consolidate traffic from other cities by continuing the flight east of Vancouver. This is especially important for new entrants building up traffic or flying from Canada to less mature Oriental markets eg. China, Taiwan, Korea, Malaysia, Thailand and the Philippines.

These international flights operate on very narrow operational windows; they must be timed around connecting services and curfews at each airport, provide attractive schedules to the market, satisfy crew duty constraints, and allow a satisfactory level of aircraft utilization and yet still have sufficient slack to ensure adequate on-time performance. When, because of airside congestion or insufficient gates at overseas airports these flights must operate at specific landing slots, very little flexibility can remain. The problems of scheduling intercontinental flights are compounded when multiple leg flights are operated. Such a round trip flight might be delayed four times at Vancouver alone. It will be delayed on landing at VIA from the Orient, further delayed when taking off for Toronto, and again delayed as it transits Vancouver on its westbound journey. This assumes, of course, that additional problems are not encountered at Toronto. If Vancouver is subject to mounting delays because of its inadequate runway capacity, such multiple-leg intercontinental flights involving Vancouver may be impossible to operate within satisfactory on-time performance standards.

While this effect will not threaten the well established services to Hong Kong and Tokyo, it may thwart the plans of new carriers to enter Vancouver or to develop new destinations in the Orient from Vancouver. Although Thai International's Toronto-Seattle-Tokyo/Taipei-Bangkok routing is based on factors other than Vancouver congestion, the fact that Canada's only service to the growing Taiwan market bypasses Vancouver altogether is surely significant.

Reduction of Frequencies on Capacity Controlled Routes

Many of Canada's bilateral air agreements, particularly those with New Zealand and Australia, include strict capacity controls. This has led to a considerable shortfall of capacity on several key Pacific routes and limited frequencies; considerably less than daily. The agreements allow airlines to reduce frequencies and use larger aircraft on the routes, often reducing operating costs. A carrier's desire to maintain high yields (revenue per passenger-mile) will often prompt it to use smaller aircraft on more frequent flights since these attract the highest proportion of premium business travellers. Vancouver, with a relatively modest traffic base, can thus compete with larger west coast gateways because it can still offer a satisfactory frequency of intercontinental services to the Canadian hinterland. However, growing airside congestion may encourage carriers to use larger equipment, reduce frequencies below a competitive level, and thus exacerbate the disruptive effects of the capacity controls. Vancouver's ability to service the all-important hinterland markets will suffer accordingly.

Air Cargo Impacts

Any factor that discourages the entry of new carriers to Vancouver will frustrate development of the Lower Mainland's air cargo potential. Long haul international flights are particularly important for air freight since time savings can become considerable. If congestion problems encourage carriers to use other gateways, and to overfly Vancouver, negative impacts could be pronounced.

Airside and groundside problems may complicate gate utilization. More slack time may be required in gate schedules if pushback times become more and more unpredictable. The lack of sufficient runway capacity thus exacerbates the growing shortage of gates. The 747 Combi aircraft requires a longer period at the gate than other widebody aircraft. The additional time is required to service cargo conveyed on the main deck. When long station stops are combined with growing but unpredictable delays at enroute airports, the integrity of the operation is threatened further. With such aircraft affected by this two-edged sword, these aircraft may become less attractive for services to Vancouver. The Airport's new main deck loader was originally purchased to facilitate such wide body all-cargo and combi operations. But mounting congestion may weigh particularly heavily on main-deck cargo aircraft, and could ultimately defeat the original purpose of the new loader.

The shortage of airside capacity may require airlines to constrain total capacity at Vancouver. Frequencies may be reduced, and passenger load factors correspondingly increased. This will result in reduced belly capacity for air cargo. Many routes, including the Canadian domestic, Pacific and Atlantic services already suffer from a lack of cargo capacity. Already, Vancouver's lack of Atlantic space has caused it to lose considerable international cargo to Seattle, Chicago and to points in Eastern Canada. Any cutback in services or increases in passenger load factors will worsen an already serious lack of international containerized capacity.

If Vancouver suffers a cutback in air cargo capacity, much of its traffic could nevertheless be accommodated by trucking services. Cargo would be palletized in Vancouver and conveyed by truck to less restricted gateways. Local shippers might perceive a poorer air freight service, and might examine using surface modes exclusively. The consequences to shippers of perishable products could be particularly severe, and they may be forced either to use surface modes or withdraw altogether from markets now reachable only by air cargo.

It is unlikely that all-cargo and courier operations will be harmed by the lack of runway capacity. These services now operate during the night, when runway capacity is generally adequate to meet the limited demands.

C. NON-AVIATION ECONOMIC IMPACTS

The distortions to aviation in Vancouver would be transmitted into the British Columbia economy through several mechanisms:

- Decreased Airport activity, resulting in curtailed employment and reduced expenditures on local goods and services.
- Increased airline operating costs at Vancouver, leading to higher ticket prices.
- Decreased flying activity by the two Canadian major carriers and local operators, all having large corporate administrative and maintenance offices in the Lower Mainland.
- Increased delays due to congestion and substitution of small gauge, frequent services by infrequent flights of large aircraft. This will increase the cost of doing business in British Columbia.
- Decreased concession, ground transportation and parking revenues at VIA.
- Curtailed tourism and convention traffic throughout British Columbia with a resulting loss of employment.
- Prospective exporters constrained by higher air freight rates, lower cargo capacities.
- Growing duopolistic behaviour by Air Canada and Canadian Airlines International with resulting distortion of market competition.
- Reduced attractiveness of Vancouver as an international business centre.

D. THE MAGNITUDE OF THE IMPACT

The ACE Team has prepared a preliminary estimate of the scale of economic impact by calculating:

- delay costs to carriers
- passenger delay costs
- foregone economic opportunities

A much more detailed benefit-cost study which includes the economic disbenefits of not constructing the runway is currently underway and is due to be completed by October 1989.

The preliminary estimates of economic impact are built on the following assumptions:

- unconstrained runway movements will increase to 328,000 in 1991 and 486,000 in 2006 under a medium growth scenario

- enplaned/deplaned passenger movements will increase to 9.3 million in 1991 and 15.4 million in 2006 under a medium growth scenario

- constrained movements will initially rise well beyond the 1991 capacity (with the enhancements underway) of 300,000 movements to approximately 350,000 movements, then, because of intolerable delays, decline to 330,000 movements. Thus by 2006, the foregone movements will be approximately 76,000/year

- capacity with a new parallel runway will be 380,000-500,000 movements depending on the fleet mix, the IFR/VFR split and the arrival/departure split

- the average cost of delay per departure at YVR from June to December 1987, as estimated by the ACE team, was $175

- the average cost of passenger time per delayed departure was $85

- based on the baseline economic impact studies for YVR, the impact of every 10,000 passengers foregone because of a lack of capacity would represent:

    - $7 million in revenue
    - 35-80 person years of employment.

Figure III-1 is Transport Canada's initial attempt to graphically illustrate the impact of constrained growth. We feel that the lost economic opportunities start much earlier (as early as 1989) and build progressively, so that Figure III-1 may more closely represent the real impact. The early economic losses include diversions of sophisticated convention groups to more easily accessible and reliable destinations.

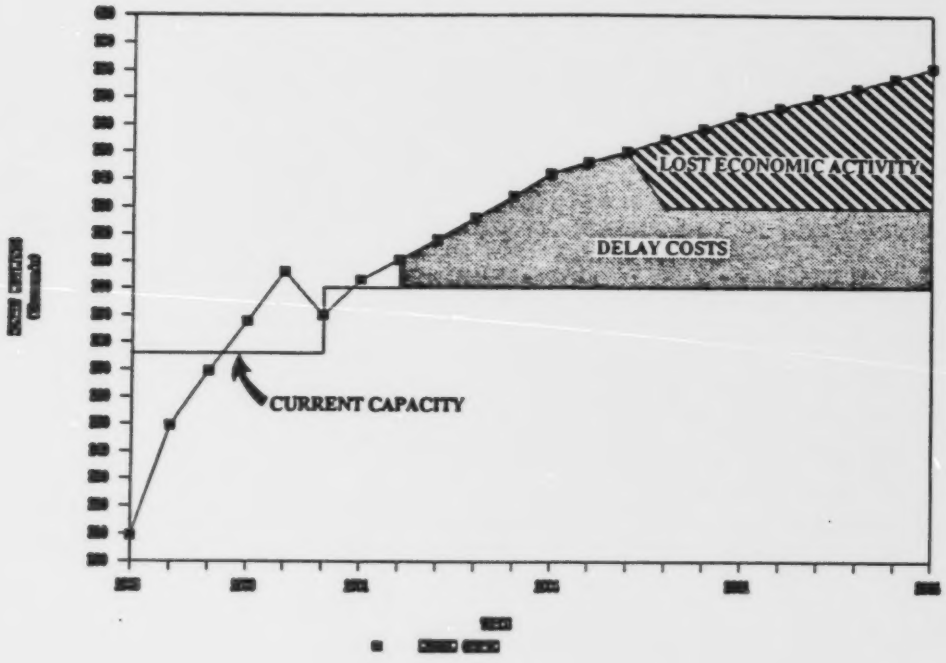

Figure III-1. The Disbenefits of Constrained Growth (Transport Canada ACE Team)

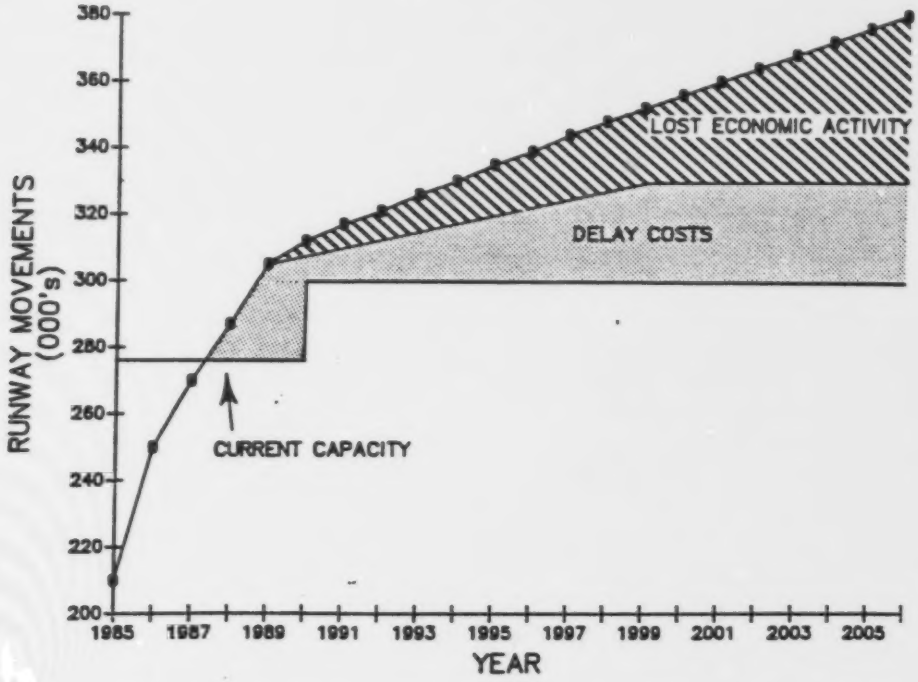

Figure III-2. Disbenefits of Constrained Growth - Revised

Figure III-3 is a graphical presentation of the year by year disbenefits of constrained traffic.

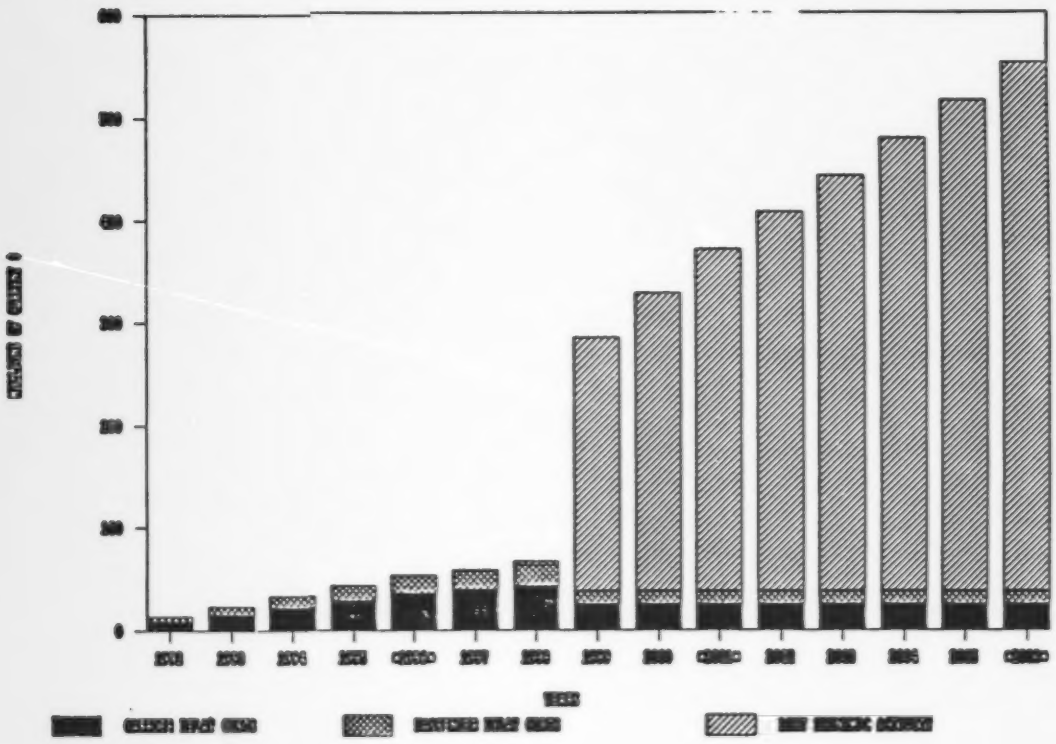

Figure III-3. YVR Disbenefits of Constrained Traffic (1989$) - ACE Team

The total impact in terms of delays and lost opportunities is estimated in Transport Canada's preliminary work to be $1 billion (present value 1989$ discounted to 1989 @ 10%) for the 14 year period 1992-2006, and a loss of potential incremental employment in the Vancouver area of 5,900 person-years. Table III-1 summarizes.

Table III-1. Summary of the Disbenefits of Insufficient Runway Capacity 1992-2006 Transport Canada ACE Team

	1996 (1989$M)	2001 (1989$M)	2006 (1989$M)	Period 1992-2006 Present Value 1989$M)
Air Carrier Delay Costs	36.0	25.7	25.7	160.8
Passenger Delay Costs	17.5	12.5	12.5	78.1
Lost Spending	-	332.4	513.8	827.2
Total Dollar Impact	53.5	370.6	552.0	1066.1
Lost Direct Employment (p.y.)		1700	2600	2600
Lost Total Employment (p.y.)		3800	5900	5900

The estimates initially prepared by Transport Canada will be refined and expanded by the benefit-cost study currently underway. It is clear, however, that many of the assumptions understate the magnitude of the impact:

- arrival delays (which are very expensive to carriers) are not included
- the incremental traffic market identified by the Pacific Rim Marketing Group of Transport Canada as over 8400 additional movements and 250,000 additional passengers in 1996 is not included in the calculations of lost economic opportunities.

The net present value in 1989 of the runway project, using the preliminary estimate of benefits to 2006 is:

Present value of runway capital cost	$ 64.5M
Present value of incremental operating and maintenance costs (@ 5% of capital)	23.7M
Present Value Costs	$ 88.2M
Present value of benefits gained through develop of the parallel runway	
Air Carrier Delay	$ 160.8M
Passenger Delay	$ 78.1M
Economic gains-spending	$ 827.2M
Present Value Benefits	$ 1066.1M

Net Present Value	$ 977.9M
B/C Ratio	12.5

The key points from this preliminary analysis are:

- the runway capital costs are exceeded by the total delay benefits by 1998
- if only direct air carrier delay cost savings are considered, these benefits exceed the runway capital costs by 2001 (9 year pay-back)
- if lost economic opportunity costs are assumed to build linearly between 1989 and 1999 (rather that suddenly appearing in 1999), then the total benefits (delay and economic opportunity) exceed total costs by 1997; a 5 year payback
- over a 25 year period, the net present value exceeds $1.3 billion
- if the capital costs for terminal/gate expansion are included for system balance, the present value of the total capital costs (runway and terminal) of $175 million is exceeded by the benefits by the year 2,000, an 8 year pay back
- the direct employment impacts will occur primarily at YVR, but some impacts can also be anticipated at the airports most severely affected by flow control: Victoria, Nanaimo, Prince George and Kelowna
- the lost spending and secondary employment impacts will occur primarily in the lower mainland, but some impact can be expected throughout B.C. as a result of reduced plant locations, expansions etc. as businesses find other locations better served by air and therefore more attractive.

IV THE BUSINESS CASE FOR GROWTH

If the expansion of capacity at Vancouver International Airport is examined as a business decision, the questions which one would want answered are:

- is the project affordable? i.e. can the debt be serviced over the life of the project?
- is it a wise investment? will it provide an adequate rate of return.
- is it the best use of money? would another investment in aviation infrastructure in the lower mainland provide a higher return?

Assumptions

The assumptions used in examining the business case are:

- two scenarios will be examined; a constrained scenario whereby only the current terminal expansion will be completed, and a growth scenario whereby the runway will be built and the gates/terminal expanded
- the total system enhancement capital cost (gates plus runway) will be considered as the investment for the growth scenario
- forecasts will be in current (i.e. inflated) dollars over a 20 year period, and an interest rate of 12% will be used.
- The constrained scenario will consist of:
  - movements capped at 300,000/year
  - passenger traffic continues to grow for several years after movements are capped to reflect higher load factors and larger aircraft. Passenger traffic is capped at 10 million E/D per year
  - real revenue growth, beyond inflation, does not occur because concessions cannot be expanded
  - capital investment is $22.5 million in the 1990 to 1993 period.
- The growth scenario consists of:
  - movements capped at 400,000/year
  - passenger traffic capped at 15 million E/D per year
  - real growth in concession revenues through expanded concessions. There is the potential in Vancouver for significantly higher unit concession sales, but current space limitations preclude fulfilling this potential.
  - capital investment is $217 million in 1992 and $86 million (current $) in 2001.

Tables IV-1 and IV-2 illustrate the constrained scenario financial forecasts and the growth scenario financial forecasts respectively.

YVR - FINANCIAL FORECASTS
BASELINE SCENARIO
ASSUMPTIONS
- CONSTRAINED - NO RUNWAY, NO NE FINGER
- MOVEMENTS CAPPED AT 300,000
- PAX CAPACITY CAPPED AT 10 MILLION
- REAL REVENUE GROWTH CAPPED BY LACK OF CONCESSIONS
- CAPITAL INVESTMENT CURRENTLY PLANNED IMPROVEMENTS ONLY - $22.5M 1990-1993

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
FACTORS										
INFLATION		1.380	1.038	1.025	1.028	1.038	1.038	1.035	1.033	1.038
PASSENGER GROWTH		1.059	1.040	1.028	1.057	1.057	1.049	1.000	1.000	1.000
PASSENGERS	7,757,000	8,214,000	8,542,560	8,781,752	9,282,312	9,811,403	10,000,000	10,000,000	10,000,000	10,000,000
MOVEMENT GROWTH - MUT/OUT		1.020	1.020	1.020	1.177	1.031	1.000	1.000	1.000	1.000
MOVEMENTS - MUT/OUT	141,752	144,635	147,518	150,401	177,000	181,800	181,800	181,800	181,800	181,800
MOVEMENT GROWTH - OTHER		1.096	1.087	0.981	0.822	0.961	1.000	1.000	1.000	1.000
MOVEMENTS - OTHER	127,752	140,298	152,482	149,599	123,000	118,200	118,200	118,200	118,200	118,200
MOVEMENTS - TOTAL	269,504	284,933	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
REVENUES										
AIR TRANSPORTATION TAX	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LANDING FEES/FUEL CHARGES	$15,223,420	$15,674,274	$16,594,203	$17,341,473	$20,979,614	$22,452,135	$23,305,317	$24,121,003	$24,916,996	$25,863,842
CONCESSIONS	$13,428,946	$13,514,019	$14,586,654	$15,372,064	$16,703,224	$18,326,209	$19,954,713	$20,653,128	$21,334,681	$22,145,399
GENERAL TERMINAL FEES	$10,474,380	$10,537,155	$11,375,070	$11,985,911	$13,023,843	$14,289,317	$15,559,095	$16,103,663	$16,635,084	$17,267,217
SPACE,OTHER RENTALS	$4,838,303	$5,065,531	$5,256,021	$5,389,472	$5,540,377	$5,750,911	$5,969,446	$6,178,376	$6,382,263	$6,624,789
CAR PARKING	$6,765,024	$6,508,482	$7,026,036	$7,403,335	$8,044,434	$8,826,079	$9,610,382	$9,946,746	$10,274,988	$10,665,438
SECURITY FEES	$266,227	$30,780	$33,228	$35,012	$38,044	$41,740	$45,450	$47,040	$48,593	$50,439
SALES OF UTILITIES	$310,156	$342,760	$373,716	$397,723	$436,486	$483,686	$531,934	$556,057	$580,151	$608,219
FEES/MISC.	$1,105,914	$1,091,310	$1,178,091	$1,241,354	$1,348,851	$1,479,913	$1,611,421	$1,667,821	$1,722,859	$1,788,328
TOTAL REVENUES	$52,412,370	$52,764,311	$56,427,019	$59,166,344	$66,115,072	$71,649,993	$76,587,757	$79,273,834	$81,895,615	$85,013,670
EXPENSES										
OPERATING EXPENSES										
SALARIES WAGES BENEFITS	$8,920,124	$9,247,949	$9,695,365	$10,037,126	$10,421,348	$10,925,532	$11,454,110	$11,973,554	$12,492,368	$13,096,748
MATERIALS SUPPLIES SERVICES	$10,218,475	$7,779,405	$8,075,022	$8,276,898	$8,508,651	$8,831,980	$9,167,595	$9,488,461	$9,801,580	$10,174,040
DEPRECIATION	$6,366,764	$7,098,264	$6,388,438	$5,749,594	$5,174,634	$5,782,171	$5,203,954	$4,683,559	$4,215,203	$3,793,682
OTHER DIRECT OPERATING	$1,788,030	$1,934,989	$2,048,554	$2,140,805	$2,589,958	$2,771,716	$2,877,041	$2,977,738	$3,076,003	$3,192,891
TOTAL OPERATING	$27,293,393	$26,060,607	$26,207,379	$26,204,423	$26,694,591	$28,311,399	$28,702,700	$29,123,311	$29,585,153	$30,257,362
CONTRIBUTION FROM OPS	$25,118,977	$26,703,704	$30,219,640	$32,961,921	$39,420,481	$43,338,593	$47,885,058	$50,150,524	$52,310,462	$54,756,309
ALLOCATED COSTS										
OVERHEAD/MANAGEMENT SERVICES	$4,885,450	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713
TERMINAL CONTROL	$8,769,000	$9,309,000	$9,855,349	$10,299,154	$12,459,977	$13,334,393	$13,841,100	$14,325,538	$14,798,201	$15,360,616
GRANTS IN LIEU OF TAXES	$3,454,103	$4,160,077	$4,318,160	$4,426,114	$4,550,045	$4,722,947	$4,902,419	$5,074,003	$5,241,446	$5,440,621
	$17,108,553	$17,325,790	$18,030,222	$18,581,981	$20,866,735	$21,914,053	$22,600,232	$23,256,255	$23,896,440	$24,657,949
TOTAL EXPENSES	$44,401,946	$43,386,397	$44,237,601	$44,786,404	$47,561,326	$50,225,452	$51,302,931	$52,379,565	$53,481,593	$54,915,311
PROFIT	$8,010,424	$9,377,914	$12,189,419	$14,379,939	$18,553,746	$21,424,541	$25,284,826	$26,894,269	$28,414,022	$30,098,359
RETAINED (DEFICIT) BEGINNING	($14,416,873)	($6,406,449)	$2,971,465	$15,160,884	$29,540,823	$48,094,569	$69,519,109	$94,803,935	$121,698,204	$150,112,227
RETAINED (DEFICIT) END	($6,406,449)	$2,971,465	$15,160,884	$29,540,823	$48,094,569	$69,519,109	$94,803,935	$121,698,204	$150,112,227	$180,210,586
CASH BEGINNING	($8,050,109)	($39,685)	$16,436,493	$35,014,349	$55,143,882	$78,872,263	$106,078,974	$136,567,754	$168,145,582	$200,774,807
CASH END	($39,685)	$16,436,493	$35,014,349	$55,143,882	$78,872,263	$106,078,974	$136,567,754	$168,145,582	$200,774,807	$234,666,848
CAPITAL					$22,500,000					
DEBT SERVICE @12% -20years						$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300
CUMULATIVE DEBT SERVICE						$3,012,300	$6,024,600	$9,036,900	$12,049,200	$15,061,500
CUMULATIVE SURPLUS AFTER DEBT						$103,066,674	$133,555,454	$165,133,282	$197,762,507	$231,654,548

YVR - FINANCIAL FORECASTS
BASELINE SCENARIO
ASSUMPTIONS
- CONSTRAINED - NO RUNWAY, NO NE FINGER
- MOVEMENTS CAPPED AT 300,000
- PAX CAPACITY CAPPED AT 10 MILLION
- REAL REVENUE GROWTH CAPPED BY LACK OF CONCESSIONS
- CAPITAL INVESTMENT CURRENTLY PLANNED IMPROVEMENTS ONLY - $22.5M 1990-1993

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
FACTORS										
INFLATION	1.043	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046
PASSENGER GROWTH	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PASSENGERS	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
MOVEMENT GROWTH - MUT/OUT	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MOVEMENTS - MUT/OUT	181,800	181,800	181,800	181,800	181,800	181,800	181,800	181,800	181,800	181,800
MOVEMENT GROWTH - OTHER	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MOVEMENTS - OTHER	118,200	118,200	118,200	118,200	118,200	118,200	118,200	118,200	118,200	118,200
MOVEMENTS - TOTAL	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
REVENUES										
AIR TRANSPORTATION TAX	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LANDING FEES/FUEL CHARGES	$26,975,987	$28,216,882	$29,514,859	$30,872,542	$32,292,679	$33,778,142	$35,331,937	$36,957,206	$38,657,238	$40,435,470
CONCESSIONS	$23,097,651	$24,160,143	$25,271,510	$26,433,999	$27,649,963	$28,921,861	$30,252,267	$31,643,871	$33,099,489	$34,622,066
GENERAL TERMINAL FEES	$18,009,707	$18,838,154	$19,704,709	$20,611,126	$21,559,238	$22,550,962	$23,588,307	$24,673,369	$25,808,344	$26,995,528
SPACE,OTHER RENTALS	$8,909,655	$9,227,499	$9,559,964	$9,907,722	$10,271,477	$10,651,962	$11,049,956	$11,466,254	$11,901,701	$12,357,180
CAR PARKING	$11,124,052	$11,635,758	$12,171,003	$12,730,869	$13,316,469	$13,929,048	$14,569,784	$15,239,994	$15,941,034	$16,674,321
SECURITY FEES	$52,608	$55,028	$57,559	$60,207	$62,977	$65,873	$68,904	$72,073	$75,389	$78,856
SALES OF UTILITIES	$640,716	$676,891	$715,108	$755,483	$798,138	$843,201	$890,808	$941,103	$994,238	$1,050,372
FEES/MISC.	$1,865,226	$1,951,026	$2,040,773	$2,134,649	$2,232,843	$2,335,554	$2,442,989	$2,555,367	$2,672,913	$2,795,866
TOTAL REVENUES	$86,675,602	$92,761,382	$97,035,485	$101,506,598	$106,183,804	$111,076,607	$116,194,951	$121,549,237	$127,150,345	$133,009,661
EXPENSES										
OPERATING EXPENSES										
SALARIES WAGES BENEFITS	$13,796,508	$14,575,458	$15,398,389	$16,267,782	$17,186,261	$18,156,597	$19,181,719	$20,264,718	$21,408,864	$22,617,609
MATERIALS SUPPLIES SERVICES	$10,611,524	$11,099,654	$11,610,238	$12,144,309	$12,702,947	$13,287,283	$13,898,498	$14,537,829	$15,206,569	$15,906,071
DEPRECIATION	$3,414,314	$3,072,883	$2,765,594	$2,489,035	$2,240,132	$2,016,118	$1,814,507	$1,633,056	$1,469,750	$1,322,775
OTHER DIRECT OPERATING	$3,330,185	$3,483,374	$3,643,609	$3,811,215	$3,986,531	$4,169,911	$4,361,727	$4,562,367	$4,772,236	$4,991,759
TOTAL OPERATING	$31,152,531	$32,231,369	$33,417,830	$34,712,341	$36,115,871	$37,629,910	$39,256,450	$40,997,970	$42,857,419	$44,838,214
CONTRIBUTION FROM OPS	$57,523,071	$60,530,013	$63,617,655	$66,794,257	$70,067,933	$73,446,697	$76,938,501	$80,551,267	$84,292,926	$88,171,447
ALLOCATED COSTS										
OVERHEAD/MANAGEMENT SERVICES	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713
TERMINAL CONTROL	$16,021,122	$16,758,094	$17,528,966	$18,335,299	$19,178,722	$20,060,944	$20,983,747	$21,948,999	$22,958,655	$24,014,751
GRANTS IN LIEU OF TAXES	$5,674,567	$5,935,597	$6,208,635	$6,494,232	$6,792,967	$7,105,445	$7,432,293	$7,774,179	$8,131,791	$8,505,854
	$25,552,403	$26,550,404	$27,594,314	$28,686,244	$29,828,402	$31,023,100	$32,272,754	$33,579,891	$34,947,158	$36,377,318
TOTAL EXPENSES	$56,704,933	$58,781,773	$61,012,144	$63,398,585	$65,944,273	$68,653,009	$71,529,204	$74,577,861	$77,804,577	$81,215,532
PROFIT	$31,970,669	$33,979,608	$36,023,341	$38,108,013	$40,239,531	$42,423,598	$44,665,747	$46,971,375	$49,345,769	$51,794,129
RETAINED (DEFICIT) BEGINNING	$180,210,586	$212,181,254	$246,160,863	$282,184,204	$320,292,217	$360,531,748	$402,955,346	$447,621,093	$494,592,468	$543,938,237
RETAINED (DEFICIT) END	$212,181,254	$246,160,863	$282,184,204	$320,292,217	$360,531,748	$402,955,346	$447,621,093	$494,592,468	$543,938,237	$595,732,366
CASH BEGINNING	$234,666,840	$270,051,831	$307,104,322	$345,893,257	$386,490,306	$428,969,968	$473,409,684	$519,889,938	$568,494,369	$619,309,888
CASH END	$270,051,831	$307,104,322	$345,893,257	$386,490,306	$428,969,968	$473,409,684	$519,889,938	$568,494,369	$619,309,888	$672,426,793
CAPITAL										
DEBT SERVICE @12% -20years	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300	$3,012,300
CUMULATIVE DEBT SERVICE	$18,073,800	$21,086,100	$24,098,400	$27,110,700	$30,123,000	$33,135,300	$36,147,600	$39,159,900	$42,172,200	$45,184,500
CUMULATIVE SURPLUS AFTER DEBT	$267,039,531	$804,092,022	$342,880,957	$383,478,006	$425,957,668	$470,397,384	$516,877,638	$565,482,069	$616,297,588	$669,414,493

YVR FINANCIAL FORECASTS
EXPANSION SCENARIO
ASSUMPTIONS
- MOVEMENTS CAPPED AT 400,000
- PAX TRAFFIC CAPPED AT 15M E/D
- REAL GROWTH THROUGH ADDITIONAL CONCESSION SALES
- CAPITAL - $212 MILLION 1990-1993
  - $86 MILLION 1998-2001

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
FACTORS										
INFLATION		1.360	1.038	1.025	1.028	1.038	1.038	1.035	1.033	1.038
PASSENGER GROWTH		1.059	1.040	1.028	1.057	1.057	1.049	1.049	1.049	1.048
PASSENGERS	7,757,000	8,214,000	8,542,560	8,781,752	9,282,312	9,811,403	10,292,162	10,796,478	11,325,505	11,869,130
MOVEMENT GROWTH - MUT/OUT		1.022	1.020	1.020	1.177	1.031	1.031	1.031	1.031	1.031
MOVEMENTS - MUT/OUT	141,572	144,635	147,518	150,401	177,000	181,800	186,600	191,400	196,200	201,000
MOVEMENT GROWTH - OTHER		1.097	1.087	1.082	0.935	1.012	1.012	1.012	1.012	1.012
MOVEMENTS - OTHER	127,932	140,298	152,482	165,028	154,221	156,976	159,731	162,486	165,241	168,000
MOVEMENTS - TOTAL	269,504	284,933	300,000	315,429	331,221	338,776	346,331	353,886	361,441	369,000
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
REVENUES										
AIR TRANSPORTATION TAX	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LANDING FEES/FUEL CHARGES	$15,223,420	$15,674,274	$16,594,203	$17,341,473	$20,979,814	$22,452,135	$24,027,781	$25,639,685	$27,306,854	$29,223,195
CONCESSIONS	$13,428,946	$13,514,019	$14,588,654	$15,372,064	$16,703,224	$18,326,209	$20,154,260	$22,100,600	$24,188,072	$26,575,489
GENERAL TERMINAL FEES	$10,474,380	$10,537,155	$11,375,070	$11,985,911	$13,023,843	$14,289,317	$15,559,095	$16,892,743	$18,305,263	$19,912,904
SPACE,OTHER RENTALS	$4,838,303	$5,065,531	$5,258,021	$5,389,472	$5,540,377	$5,750,911	$5,969,446	$6,178,376	$6,382,263	$6,624,789
CAR PARKING	$6,765,024	$6,508,482	$7,026,036	$7,403,335	$8,044,434	$8,826,079	$9,610,382	$10,434,136	$11,306,607	$12,299,599
SECURITY FEES	$266,227	$30,780	$33,228	$35,012	$38,044	$41,740	$45,450	$49,345	$53,471	$58,167
SALES OF UTILITIES	$310,156	$342,760	$373,716	$397,723	$436,486	$483,686	$531,934	$583,304	$638,399	$701,411
FEES/MISC.	$1,105,914	$1,091,310	$1,178,091	$1,241,354	$1,348,851	$1,479,913	$1,611,421	$1,749,544	$1,895,836	$2,062,336
TOTAL REVENUES	$52,412,370	$52,764,311	$56,427,019	$59,166,344	$66,115,072	$71,649,993	$77,509,769	$85,627,734	$90,076,766	$97,457,890
EXPENSES										
OPERATING EXPENSES										
SALARIES WAGES BENEFITS	$8,920,124	$9,247,949	$9,695,365	$10,037,126	$10,421,348	$10,925,532	$11,454,110	$11,973,554	$12,492,368	$13,096,748
MATERIALS SUPPLIES SERVICES	$10,218,475	$7,779,405	$8,075,022	$8,276,898	$8,506,651	$8,831,980	$9,167,595	$9,488,461	$9,801,580	$10,174,040
DEPRECIATION	$6,366,764	$7,096,264	$6,388,438	$5,749,594	$5,174,634	$9,957,171	$17,036,454	$16,184,631	$15,375,400	$14,606,630
OTHER DIRECT OPERATING	$1,788,030	$1,934,989	$2,048,554	$2,140,805	$2,589,958	$2,771,716	$2,966,229	$3,165,219	$3,371,031	$3,607,603
TOTAL OPERATING	$27,293,393	$26,060,607	$26,207,379	$26,204,423	$26,694,591	$32,486,399	$40,624,388	$40,811,865	$41,040,378	$41,485,021
CONTRIBUTION FROM OPS	$25,118,977	$26,703,704	$30,219,640	$32,961,921	$39,420,481	$39,163,593	$36,885,381	$42,815,870	$49,036,388	$55,972,868
ALLOCATED COSTS										
OVERHEAD/MANAGEMENT SERVICES	$4,885,450	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713
TERMINAL CONTROL	$8,769,000	$9,309,000	$9,855,349	$10,299,154	$12,459,977	$13,334,393	$14,270,174	$15,227,489	$16,217,626	$17,355,746
GRANTS IN LIEU OF TAXES	$3,454,103	$4,160,077	$4,318,160	$4,426,114	$4,550,045	$4,722,947	$4,902,419	$5,074,003	$5,241,446	$5,440,621
	$17,108,553	$17,325,790	$18,030,222	$18,581,981	$20,866,735	$21,914,053	$23,029,306	$24,158,205	$25,315,784	$26,653,080
TOTAL EXPENSES	$44,401,946	$43,386,397	$44,237,601	$44,786,404	$47,561,326	$54,400,452	$63,653,694	$64,970,070	$66,356,162	$68,138,101
PROFIT	$8,010,424	$9,377,914	$12,189,419	$14,379,939	$18,553,746	$17,249,541	$13,856,076	$18,657,665	$23,720,604	$29,319,789
RETAINED (DEFICIT) BEGINNING	($14,416,873)	($6,406,449)	$2,971,465	$15,160,884	$29,540,823	$48,094,569	$65,344,109	$79,200,185	$97,857,850	$121,578,453
RETAINED (DEFICIT) END	($6,406,449)	$2,971,465	$15,160,884	$29,540,823	$48,094,569	$65,344,109	$79,200,185	$97,857,850	$121,578,453	$150,898,242
CASH BEGINNING	($8,050,109)	($39,685)	$16,436,493	$35,014,349	$55,143,882	$78,872,263	$106,078,974	$136,971,504	$171,813,800	$210,909,803
CASH END	($39,685)	$16,436,493	$35,014,349	$55,143,882	$78,872,263	$106,078,974	$136,971,504	$171,813,800	$210,909,803	$254,636,221
CAPITAL					$106,000,000	$111,000,000				
DEBT SERVICE						$13,387,880	$25,518,240	$25,518,240	$25,518,240	$25,518,240
CUMULATIVE DEBT SERVICE						$13,387,880	$38,906,120	$64,424,360	$89,942,600	$115,460,840
CUMULATIVE SURPLUS AFTER DEBT SERVICE						$92,691,094	$98,065,384	$107,389,440	$120,967,203	$139,375,381
ANNUAL INCREMENTAL CASH FLOW	$0	$0	$0	$0	$0	$4,175,000	$12,754,512	$15,854,973	$19,341,348	$23,257,167
(CASH OVER BASE SCENARIO)										
NPV INCREMENTAL CASH FLOW 25 YEARS,14.5%			$237,793,770							

YVR FINANCIAL FORECASTS
EXPANSION SCENARIO
ASSUMPTIONS
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- REAL GROWTH THROUGH ADDITIONAL CONCESSION SALES
- CAPITAL - $212 MILLION 1990-1993
  - $86 MILLION 1998-2001

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
FACTORS										
INFLATION	1.043	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046
PASSENGER GROWTH	1.030	1.030	1.030	1.029	1.028	1.025	1.025	1.025	1.025	1.000
PASSENGERS	12,225,204	12,591,960	12,969,718	13,345,840	13,719,524	14,062,512	14,414,075	14,774,427	15,000,000	15,000,000
MOVEMENT GROWTH - MUT/OUT	1.014	1.014	1.014	1.014	1.014	1.010	1.000	1.000	1.000	1.000
MOVEMENTS - MUT/OUT	204,000	207,000	210,000	213,000	216,000	218,000	218,000	218,000	218,000	218,000
MOVEMENT GROWTH - OTHER	0.997	0.997	0.997	0.997	0.997	0.991	1.000	1.000	1.000	1.000
MOVEMENTS - OTHER	171,140	174,280	177,420	180,560	183,703	182,000	182,000	182,000	182,000	182,000
MOVEMENTS - TOTAL	375,140	381,280	387,420	393,560	399,703	400,000	400,000	400,000	400,000	400,000
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
REVENUES										
AIR TRANSPORTATION TAX	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LANDING FEES/FUEL CHARGES	$30,906,509	$32,780,804	$34,768,763	$36,877,279	$39,113,665	$41,322,023	$43,222,836	$45,211,086	$47,290,796	$49,466,173
CONCESSIONS	$28,835,280	$31,377,219	$34,143,240	$37,117,026	$40,310,607	$43,651,208	$47,268,649	$51,185,873	$55,427,723	$57,977,398
GENERAL TERMINAL FEES	$21,392,234	$23,047,565	$24,830,986	$26,726,434	$28,738,614	$30,812,105	$33,035,198	$35,418,688	$37,974,146	$39,720,957
SPACE,OTHER RENTALS	$6,909,655	$7,227,499	$7,559,964	$7,907,722	$8,271,477	$8,651,965	$9,049,956	$9,466,254	$9,901,701	$10,357,180
CAR PARKING	$13,213,336	$14,235,784	$15,337,349	$16,508,110	$17,750,973	$19,031,706	$20,404,843	$21,877,053	$23,455,482	$24,534,434
SECURITY FEES	$62,489	$67,324	$72,534	$78,070	$83,948	$90,005	$96,499	$103,461	$110,926	$116,029
SALES OF UTILITIES	$761,054	$828,143	$901,147	$979,635	$1,063,924	$1,152,093	$1,247,568	$1,350,956	$1,462,912	$1,545,508
FEES/MISC.	$2,215,547	$2,386,986	$2,571,691	$2,767,998	$2,976,395	$3,191,142	$3,421,383	$3,668,236	$3,932,899	$4,113,812
TOTAL REVENUES	$104,296,103	$111,951,324	$120,185,673	$128,962,275	$138,309,604	$147,902,246	$157,746,932	$168,201,606	$179,556,585	$187,851,490
EXPENSES										
OPERATING EXPENSES										
SALARIES WAGES BENEFITS	$13,796,508	$14,575,458	$15,398,389	$16,267,782	$17,186,261	$18,156,597	$19,181,719	$20,264,718	$21,408,864	$22,617,609
MATERIALS SUPPLIES SERVICES	$10,611,524	$11,099,654	$11,610,238	$12,144,309	$12,702,947	$13,287,283	$13,898,498	$14,537,829	$15,206,569	$15,906,071
DEPRECIATION	$13,876,298	$13,182,483	$12,523,359	$16,197,191	$15,387,332	$14,617,965	$13,887,067	$13,192,713	$12,533,078	$11,906,424
OTHER DIRECT OPERATING	$3,815,408	$4,046,790	$4,292,203	$4,552,500	$4,828,582	$5,101,203	$5,385,859	$5,581,308	$5,838,048	$6,106,599
TOTAL OPERATING	$42,099,738	$42,904,386	$43,824,189	$49,161,782	$50,105,121	$51,163,048	$52,303,142	$53,576,569	$54,986,559	$56,536,702
CONTRIBUTION FROM OPS	$62,196,365	$69,046,939	$76,361,484	$79,800,493	$88,204,482	$96,739,198	$105,443,790	$114,705,037	$124,570,026	$131,294,788
ALLOCATED COSTS										
OVERHEAD/MANAGEMENT SERVICES	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713	$3,856,713
TERMINAL CONTROL	$18,355,472	$19,468,621	$20,649,276	$21,901,531	$23,229,727	$24,541,278	$25,670,176	$26,851,005	$28,086,151	$29,378,114
GRANTS IN LIEU OF TAXES	$5,674,567	$5,935,597	$6,208,635	$6,494,232	$6,792,967	$7,105,443	$7,432,293	$7,774,179	$8,131,791	$8,505,854
	$27,886,752	$29,260,931	$30,714,624	$32,252,476	$33,879,407	$35,503,434	$36,959,183	$38,481,896	$40,074,655	$41,740,680
TOTAL EXPENSES	$69,986,490	$72,165,317	$74,538,813	$81,414,258	$83,984,528	$86,666,482	$89,262,325	$92,058,465	$95,061,214	$98,277,383
PROFIT	$34,309,613	$39,786,007	$45,646,860	$47,548,018	$54,325,076	$61,235,764	$68,484,607	$76,223,141	$84,495,371	$89,554,108
RETAINED (DEFICIT) BEGINNING	$150,898,242	$185,207,855	$224,993,862	$270,640,722	$318,188,740	$372,513,816	$433,749,580	$502,234,187	$578,457,328	$662,952,699
RETAINED (DEFICIT) END	$185,207,855	$224,993,862	$270,640,722	$318,188,740	$372,513,816	$433,749,580	$502,234,187	$578,457,328	$662,952,699	$752,506,806
CASH BEGINNING	$254,836,221	$303,022,133	$355,990,623	$414,160,842	$477,906,051	$547,618,458	$623,472,187	$705,843,861	$795,259,716	$892,288,164
CASH END	$303,022,133	$355,990,623	$414,160,842	$477,906,051	$547,618,458	$623,472,187	$705,843,861	$795,259,716	$892,288,164	$993,748,696
CAPITAL			$86,000,000							
DEBT SERVICE	$25,518,240	$25,518,240	$34,888,240	$34,888,240	$34,888,240	$34,888,240	$34,888,240	$34,888,240	$34,888,240	$34,888,240
CUMULATIVE DEBT SERVICE	$140,979,080	$166,497,320	$201,385,560	$236,273,800	$271,162,040	$306,050,280	$340,938,520	$375,826,760	$410,715,000	$445,603,240
CUMULATIVE SURPLUS AFTER DEBT	162,043,053	$189,493,303	$212,775,282	$241,632,251	$276,456,418	$317,421,907	$364,905,341	$419,432,956	$481,573,164	$548,145,456
ANNUAL INCREMENTAL CASH FLOW (CASH OVER BASE SCENARIO)	$26,082,485	$29,299,543	$32,907,953	$41,163,834	$45,273,000	$49,427,486	$53,624,541	$58,292,027	$63,469,567	$65,405,478

A comparison of the Constrained Financial Forecasts and the Growth Forecasts indicates that:

- the $217 million outlay in 1990-1993, and the $86 million (current$) in 1998-2001 can be financed commercially at 12% interest over the expected life of the project (40 years for the runway and 20 years for the terminal)

- over a 25 year period, the rate of return on the runway and terminal capital investments, considering only the incremental revenue from those investments is 14.5%

- considering incremental revenues and incremental costs of the Growth Scenario over the Constrained Scenario, the payback on the incremental investment is 18 years.

V CONCLUSIONS

From the examination of the operational, economic and business case, it is possible to conclude that:

- Vancouver International Airport is an essential component of the B.C. economy, and anything which diminishes its utility will have significant economic consequences
- if Vancouver is to retain all of its current roles, including its role as a hub for British Columbia, additional runway capacity is needed as soon as possible
- the environmental impact of the new runway will be acceptable after mitigation and compensation actions have been implemented
- there will be technological improvements and changes to traffic patterns which may ease the rate of increase in the capacity demand imbalance at Vancouver International, but these are all 10-15 years away, whereas the problem is here today
- the expansion of the airport is supportable from a financial and economic perspective.

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APPENDIX A

STUDY TERMS OF REFERENCE

TERMS OF REFERENCE April 24, 1989

BUSINESS CASE FOR PARALLEL RUNWAY AT VANCOUVER AIRPORT

Objectives:

- To ensure that the operational requirements for the need to develop a parallel runway at Vancouver International Airport (VIA) have been fully analyzed and documented.

- To estimate the economic losses to British Columbia as a result of a failure to address the current capacity problems at VIA.

The Contractor will:

1. Conduct a complete review of existing Transport Canada analyses and data regarding:

   - capacity and utilization of airport facilities for the movement of aircraft;

   - implications of utilization trends and capacity limitations for existing and projected traffic levels;

   - direct construction costs of a parallel runway, including costs of pre-loading and associated taxiways and other related capital costs such as lighting and navigation aids;

   - airport revenue implications of increased capacity as a result of a parallel runway; and

   - direct cost implications to the airport, carriers and others due to reduced delays as a result of a parallel runway.

2. Conduct a survey of existing information to estimate the short and long term economic losses to British Columbia should there be no action to address current capacity limitations at VIA alia taking the following factors into consideration:

   - implications for aircraft and passenger volumes for international, trans-border and domestic flights;

   - competitiveness of VIA with other airports (eg. Seatac) for passenger and cargo business;

.../2

- estimated direct, indirect and induced expenditures associated with traffic volume losses as a result of capacity limitations;

- economic implications for Vancouver and all of the other regions of the province, given the airport serves some of the transportation needs of each region.

3. Provide a written report summarizing the findings in parts 1 and 2 outlining any data deficiencies, information gaps and analytical requirements which should be addressed in order to achieve a reasonable level of confidence in the estimated level of values used to support the economic and financial case in support of addressing capacity limitations at VIA.

4. Timing

- A draft report will be provided to officials serving the CCVIA four weeks from the commencement of the study;

- A final report to the CCVIA will be submitted within two weeks of receiving comments on the draft from the officals' committee.

APPENDIX B

VANCOUVER INTERNATIONAL AIRPORT
SOUTH AIRPORT BASED
AIRCRAFT AND ESTIMATED MOVEMENTS 1987

EXTRACTED FROM VANCOUVER INTERNATIONAL AIRPORT SOUTH SIDE ACITIVITY STUDY

TABLE 3.1
SUMMARY OF AIRCRAFT MOVEMENTS

TYPE OF AIRCRAFT MOVEMENT	OPERATOR	BUILDING DESIGNATION	AIRCRAFT TYPE	ANNUAL MOVEMENTS	DESTINATIONS
o Scheduled	Burrard Air	T-42	6-Chieftain 2-Cessna 337 1-Islander	18,000	Victoria, Nanaimo Qualicum, Campbell River, Powell River
	Skylink	T-42	7-Cessna402B 1-Fairchild Metro-2	15,000	Terrace, Smithers, Victoria Nanaimo, Powell River
	Aquila	T-42	1-Fairchild Merlin	10,000	Qualicum, Nanaimo, Powell River, Gillies, Sechelt
	Pacific Coastal	T-42	1-Navajo	4,500	Bella Bella
	Waglisa	T-42	2-Navajo	2,000	Bella Bella, Ocean Falls, Port Hardy
	Wilderness	T-42	2-Navajo 1-Beechcraft King Air	2,000	Bella Coola
	Pacific Rim	T-42	1-Cessna 172 1-Aztec	1,500	Port Alberni
	Sub-Total T-42 (South Side Terminal)			53,000	
	Anderson Air	T-536	2-Cessna 414 1-Cessna 421 1-Cessna Citation	1,000	
	IC Air	T-536	3-PA-31-350 2-Cessna 421 1-ACG903 1-DC-3	1,000	
Sub-Total Scheduled				55,000	
o Charter	Canada West Air	T-41	3-Convair	2,500	
	West Air	T-566	3-Piper Cheyene 2-Cessna Citation	3,000	
	Jet West	T-566	1-King Air 2-Cessna 400	1,000	
	Aviation Business Flights	T-571	1-Cessna 421	200	
	Selkirk Remote Sensing	T-122	1-Cessna 500 1-Cessna 206 1-Cessna 180	800	
	Kelowna Flight Craft	T-130		700	
	Can West	T-571			
	Pan West	T-571			
	Venture	T-481	2-Skymaster		
	Canadian IFR	T-481	2-Beech 95 1-Cessna 421 1-Cessna 172	6,800	(Estimated including visiting charter flights)
	Canada Jet Charter	T-481	4-Learjets		
Sub Total Charter				15,000	
o Corporate and Private	BC Tel	T-572	Cessna Citation	1,500	
	BC Government	T-481	Various	5,500	
	Crown Forest	T-481	1-Gruman Goose	900	
	BC Forest Products	T-481	1-Falcon 20	400	
	Jim Pattison Group	T-481	1-Learjet		
	Woodwards	T-481	1-Cessna 550		
	MacMillan Bloedel	T-136	1-Beech 100 2-Gruman Goose		
	Canadian Kenworth	T-536			
	Canadian Teamsters	T-536	1-HS-125-700A		
	Canadian Forest Products	T-536	1-Cessna Citation		
	Kaiser Resources	T-536	1-HS-125-600A 1-Cessna 185		
	JMB Aviation	T-536	1-Canadair Challenger		
	Weldwood	T-536	1-Cessna Citation		(36,700 estimated including visiting corporate & private aircraft)
Sub Total Corporate and Private				45,000	
o GOVERNMENT	Transport Canada	T-536	1-Twin Otter 3-King Air 1-DHC-2	2,000	
	Other			8,000	
Sub Total Government				10,000	
TOTAL ALL:				125,000	